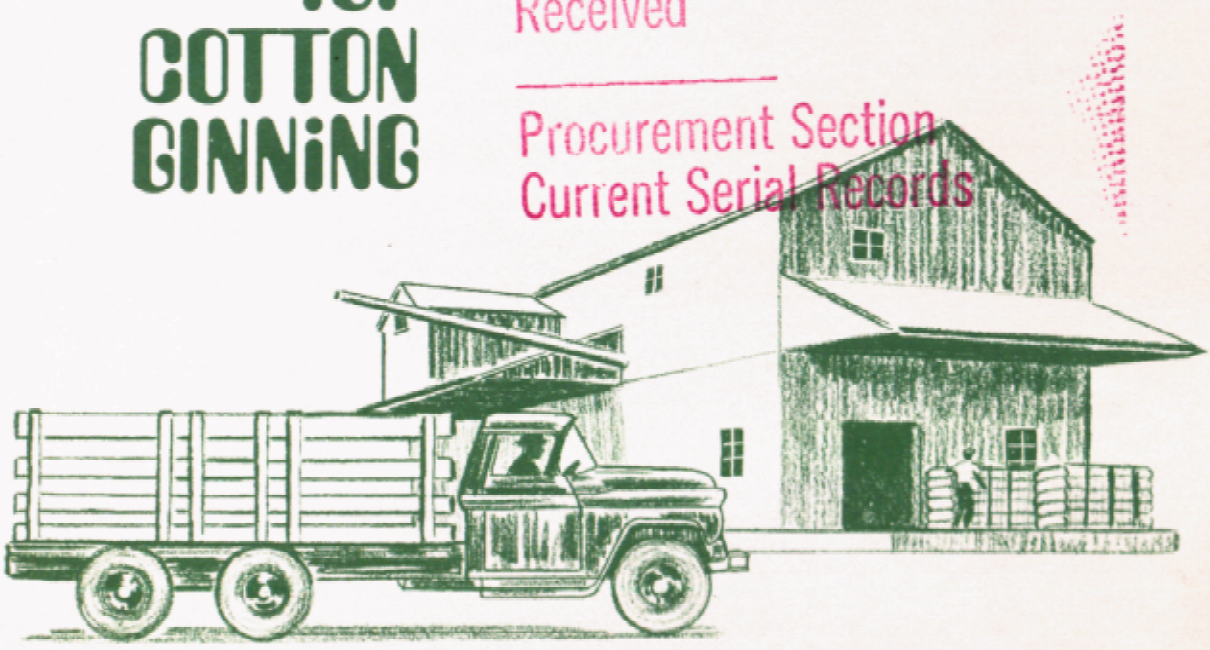
ECONOMIC MODELS for COTTON GINNING



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ABSTRACT

As plant size increases, operating costs per bale decline, revealing economies of scale in ginning throughout the range of gin sizes studied. This and other findings were noted in an analysis of capital investment requirements and operating costs for 10 ginning models ranging in hourly rated capacities from 6 to 36 bales. Seed cotton assembly, traditionally a producer-borne cost, could be an obstacle to the successful establishment and operation of a 36-bale gin--which was determined to be the optimal size--because of the greater hauling distances involved. The analysis shows, however, that with a uniform area ginning charge and other seemingly realistic assumptions, a 36-bale gin could either absorb the assembly cost or take over the assembly function completely and still compete favorably with smaller plants able to furnish only the ginning service.

Key Words: Cotton ginning, economic-engineering model, capacity, economies of scale, gin operating costs.

PREFACE

This report supersedes the earlier USDA report entitled "Engineering and Economic Aspects of Cotton Gin Operations--Midsouth, West Texas, Far West" (Economic Research Service, Agricultural Economic Report 116, July 1967). Equipment recommendations and operating cost estimates were again developed for a series of 10 model gin plants, but the current series covers a range in hourly ginning capacities of 6 to 36 bales. A range of 6 to 24 bales was covered in the previous report. The availability of single-battery gin plants with rated capacities greater than 24 bales an hour is the result of recent technological advancements, mainly in gin pressing speeds.

In addition to extending the series to cover plant capacities up to 36 bales, this report uses estimated costs for the 1970-71 season.

Size and power requirements for ginning machinery and equipment are specified in sequential order for each gin model. Primary and secondary gin construction and operating costs, combined with estimates based on observations made in previous studies, are used as the bases for costs shown in this report.

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Special recognition is due Vernon P. Moore and Victor L. Stedronsky, of the Agricultural Engineering Research Division, Agricultural Research Service, USDA, for their assistance in developing power requirements and machinery specifications essential to this study. Vernon Moore is Investigations Leader, Stoneville Cotton Ginning Research Laboratory, Stoneville, Miss. Victor Stedronsky, retired, formerly was Engineer-in-Charge, Southwestern Cotton Ginning Research Laboratory, Mesilla Park, N. Mex.

CONTENTS

SUMMARY

Cotton ginners who may find construction of new gins warranted despite cotton's economic plight can achieve the greatest cost advantage with a plant producing 36 bales an hour. Researchers found that operating costs declined as plant size increased for 10 model gins having hourly capacities starting at 6 bales and ending with 36. Thirty-six bales an hour is the largest capacity practical at present levels of technology.

When operating at full seasonal capacity, the 6-bale gin models had a per bale cost of $18.85 in the West. Cost declined to $12.80 for the 36-bale model. Per bale cost dropped from $17.98 (6-bale) to $12.61 (36-bale) in the South and from $19.03 to $13.19 in West Texas.

An obstacle to the adoption of the 36-bale plant is the added cost of assembling seed cotton from outlying areas. Assembly traditionally has been the responsibility of producers, and they prefer to have available a number of smaller, scattered gin plants to minimize the cost and inconvenience of this function.

If the ginning firm were to either reimburse producers for assembly or take over the function, this obstacle could be overcome. Either course of action seems economically feasible. Assuming other things equal, the combined cost of operating a 36-bale plant and assembling seed cotton would be slightly less than the operating cost alone for a 6-bale plant. Hence, the 36-bale firm could reimburse growers for assembly and still compete favorably with a 6-bale plant that operates at cost and is able to provide only the ginning function. If, instead, the operator of the 36-bale gin were to take over the assembly function and were able to make fuller use of trailers, he could compete with a 6-bale gin offering only the ginning service and still show a substantial profit margin.

SUMMARY AND CONCLUSIONS

Wheat millfeeds have their greatest market value in high-protein beef and dairy cattle supplements and in low-energy poultry rations. Although millfeeds are already used in many types of livestock rations, their use should increase further because of their high nutritive value and comparatively low cost.

Parametric linear programming, used to impute values for wheat millfeeds in broiler, layer, turkey, swine, beef cattle, and dairy cattle rations, suggests that the market undervalues wheat millfeeds in dairy and beef cattle supplements. USDA's Western Regional Research Laboratory, supported by the Millers' National Federation, is currently investigating ways of improving the biological availability of naturally occurring nutrients in millfeeds so as to increase their use in poultry feeds.

Increased use of millfeeds in poultry rations ultimately depends on the economic feasibility of improving nutrient availability. Laboratory improvements must be evaluated by feeding trials and the increased nutritional values compared with the costs of modifications. Even if evaluations prove the benefits of substituting improved millfeeds for other ingredients, demand for them would still have to be generated among poultry feeders. To create and maintain market demand would require the adoption and enforcement of nutritional standards and a concerted promotional and educational campaign to convince potential users of their worth.

Feed ingredient prices used in this analysis were averages for four different time periods in each of four markets -- Atlanta, Boston, Los Angeles, and the Tri-cities area of Davenport-Rock Island-Moline. The nutritional matrix for making this analysis -- including nutritional requirements for all classes of livestock studied and nutritional coefficients for ingredients used in the rations -- was developed at the Western Regional Research Laboratory. These requirements, coefficients, and prices can be used to evaluate improvements on other feed ingredients.

ECONOMIC MODELS FOR COTTON GINNING

by

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BACKGROUND

The rates gin operators pay for both fixed and variable ginning cost inputs continue to climb, while the fees they receive for services rendered either remain fixed or increase much more slowly. Greater use of more sophisticated ginning machinery has been accompanied by a rise in the general price level affecting all goods purchased. Hence, not only does it take more machinery to completely equip a modern-day gin but the purchase price of each capital item included in the ginning array is higher.

A trade publication has pointed out that the "high cost of gin machinery today demands a reasonable and dependable volume of cotton to enable the ginner to provide the service demanded of him by the producer." 1/ These volume criteria necessary to assure the longrun survival of many cotton gins often are not being met. Annual cotton production of 14 to 15 million bales was fairly common in this country during the decade following World War II. Since 1963, production has been on the decline and during 2 of the past 4 years, fell below 10 million bales. This is the lowest level for cotton production in the United States since 1945 and 1946.

With the decline in cotton production, the number of active gins in the United States is now about half the number of gins in operation in 1945. Both remodeling and new gin construction have been greatly curtailed. However, there are situations, even with the current economic plight now confronting the industry, in which new gin construction may be warranted and should be considered.

PURPOSE AND PROCEDURE

This report and its predecessor 2/ were prepared to assist those faced with the decision of either replacing existing plants or constructing complete new

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1/ "Ginners Call for New Program," Cotton Digest. Dec. 6, 1969, p. 13.

2/ Wilmot, Charles A., Victor L. Stedronsky, Zolon M. Looney, and Vernon P. Moore. Engineering and Economic Aspects of Cotton Gin Operations--Midsouth, West Texas, Far West. Agr. Econ. Rept. 116, Econ. Res. Serv., U.S. Dept. Agr., July 1967.

ginning complexes. The specific purpose of this study was to develop theoretical models incorporating the latest technologies known to ginning, for use as standards of the industry.

In updating the earlier report, a series of 10 models was again employed. However, the upper range in ginning capacity for these models was extended from 24 bales an hour to 36, in keeping with recent technological advancements, mainly in gin presses. Specifications of size and power requirements for ginning machinery and equipment in the models were derived from unpublished information collected in previous studies and from supplemental information furnished by ginning engineers and gin manufacturers. Costs were synthesized from primary data furnished by reliable industry sources and estimates based on behavioral cost patterns observed in previous ginning studies.

Input costs differ among geographic areas across the Cotton Belt. In many cases, however, these differences are relatively minor and therefore are not shown in detail. Capital investment requirements in West Texas, where seed cotton is harvested with machine strippers, exceed those in other areas enough to justify a separate discussion of this general area. Likewise, differences noted in major cost items between the West and South were also deemed sufficient to warrant separate discussions of all operating costs for these two areas. Accordingly, the Belt was divided into three geographic areas--West Texas (High Plains and Rolling Plains of Texas, and western Oklahoma); the West (New Mexico, Arizona, California, and Nevada); and the South (the Mid-South and the Southeast plus areas of Texas where cotton is machine picked).

INTERPRETATIVE QUALIFICATIONS

Adequately describing differences in gin-operating costs throughout the United States among three broad geographic areas is difficult. Land values, for example, may vary widely within a radius of a few miles. Energy rate schedules for cotton gins usually differ with each utility company. Many other examples of regional variations among input factor costs could be cited. Where local cost rates deviate from those used in the tables of this report to an extent sufficient to affect the usefulness of the findings, the reader may need to make some adjustments. It is believed that the explanation accompanying these tables is adequate for making such adjustments.

Labor crew sizes and hours of employment were based on the assumption that adequate seasonal labor would be available for both day and night crews. However, the increasing difficulty of obtaining competent gin help for such a short period of time is recognized. If seasonal labor is not available to supply two full crews when needed, the plants would be forced to operate at less than full seasonal capacity, thereby increasing per unit costs. To guarantee employment for longer periods of time than are actually necessary for processing the crop or to provide other employee benefits would help to assure the availability of an adequate supply of competent help but also would increase operating costs.

Effective February 1, 1967, gin employees, for the first time, were brought under the Fair Labor Standards Act. This Act provided for a statutory minimum of $1 an hour for the first year with annual increases which reach $1.60 an hour after February 1, 1971. Employers may be exempted from the overtime provision

of the Act during the "active season" for a period not to exceed 14 weeks. Although hourly rates used in making the labor cost estimates for this study either equal or exceed the current minimum, further increases which may be specified under this legislation will almost certainly necessitate upward revisions of these labor cost inputs. Removal of the overtime exemption would also result in increased labor costs.

In computing average costs for assembling seed cotton, only one set of estimates was developed to simplify the presentation. The area referred to as "the West" was chosen arbitrarily. For readers who may believe that certain rate substitutions are necessary to make these findings more representative of a specific locality or area, sufficient detail has been included so they may make these changes.

The merits of an automatic unloading system, including its labor-saving potential, are described in a separate section. Unfortunately, such a system is not yet available commercially and no investment cost estimates on a mass production basis are available. A further problem is that trailers are not standardized. Some models of automatic unloading systems could require special-built trailers. Consequently, no cost comparisons between automatic and conventional unloading were possible and the use of the unloading fan-suction pipe combination was incorporated in each model.

TRENDS AND DEVELOPMENTS IN GINNING

Recent technological developments in ginning have resulted mainly in increased rates of ginning and potential cost savings through reduction in gin labor requirements. Further breakthroughs in improved methods of materials handling and gin processing and in the control of dust, dirt, and fly lint emission are inevitable as ginning research and testing continue.

Ginning Innovations

For many years, cotton ginning equipment remained relatively unchanged. One of the first real milestones in the quest for faster ginning rates was the relatively recent development of the high-capacity gin stand. Until the middle 1950's, the conventional 12-inch gin saw was employed by all manufacturers. Gin stands up to the mid-1950's were capable of ginning from 1 to 2 bales an hour, depending on saw cylinder length, since 10 pounds of lint per saw per hour was the accepted rule of thumb. With the development of the high-capacity gin stand, a radical departure from the conventional stand, ginning rates increased 300 to 500 percent or more.

Gin presses also remained relatively unchanged for many years. Prior to the introduction of the high-capacity gin stand, the press had long been looked upon as the major bottleneck in the ginning process. With the advent of the high-capacity stand, the limitations of the press became more than a concern and turned into a very real and immediate problem. Research on presses by the various gin manufacturers took on top priority, and faster, more fully automatic presses were soon available. The development and incorporation of larger press

pumps, faster traveling rams, automatic bale tying equipment, and other time-saving devices have now resulted in presses with capacities nearly double those of earlier models. At the same time, up to three men of a five-man crew have been eliminated from the press crew. If a different type of bale covering could be adopted which would be fully acceptable to the industry, dressing of the press could be more fully automated, further reducing labor requirements and costs.

The traditional system of unloading seed cotton by raising it pneumatically with suction to the top of the gin is grossly inefficient from the standpoint of both power and labor utilization. Actual power requirements for unloading may run as high as 150 horsepower or more in some of the larger gin plants. For gins with hourly capacities of 15 to 18 bales, three to four men are required to operate the suction pipes and move trailers in and out of the unloading position. In plants with greater capacities, even more men are required to carry out these functions. Designing, developing, and testing of alternate methods by engineers of the ARS ginning research laboratories have resulted in the adoption of a new principle in unloading by at least one commercial gin plant. The system consists of a dump pit with a moving belt in the bottom and a series of feed control cylinders at one end through which seed cotton is metered into a hot-air line. Only one man is required to perform the unloading and trailer-handling operations at this gin, compared with five if conventional unloading is employed. About 20 horsepower are necessary to operate an automatic dumping pit system for a 36-bale gin, compared with over 150 with conventional suction unloading (app. table 18).

ARS ginning engineers have also developed a new type of seed cotton dryer--referred to as a multipath dryer, which is designed to eliminate over and under drying and accompanying fiber damage. However, since neither this innovation nor the automatic unloading system described above has yet been adopted by any gin manufacturer, they are not available commercially.

Developmental work is also well along on a completely new packaging system designed to eliminate some of the disadvantages still existing in the conventional press. This new system will produce a package consisting of a 500-pound continuous lap of cotton wound on a cardboard core at a density of 25 to 30 pounds per cubic foot. Reductions in labor and power requirements promise to be significant.

Air Pollution Control

Air pollution control has become a subject of great concern to ginners of all areas in recent years. Most States in the Cotton Belt have pollution control boards, and many have adopted air pollution control codes for cotton gin operations. These codes all differ in some respects but must at least equal Federal standards which are expected to be approved. In the face of this situation, it is difficult to make specific recommendations at this time which will be valid during years to come. However, there are several steps a ginner can take to help meet present requirements. These steps should also be adaptable to any system required in the future to meet possibly more stringent air pollution control regulations.

It has been found by experience at the USDA Ginning Research Laboratory at Stoneville, Miss., that lint fly emissions from condensers can be practically eliminated by covering condenser drums with a fine mesh wire screen or perforated metal with small holes. 3/ Only fine dust will be discharged, and if this continues to be a problem, the in-line air filter appears to be the solution. Installing the wire or metal screens will increase cost of construction and will also cause some increase in energy requirements for condenser exhaust fans. These costs have been taken into account in the specifications for model gins in this report.

The in-line air filter mentioned above as a still more efficient means for controlling high-volume fan exhaust emissions was developed by engineers at the USDA Southwestern Cotton Ginning Research Laboratory at Mesilla Park, N. Mex. It provides a practical means of collecting both lint fly and dust with a high degree of efficiency. 4/ No attempt has been made to develop the cost of incorporating these devices in cotton gins.

Another means of cutting down air pollution is installation of small-diameter cyclones in all trash lines. These cyclones are extremely efficient in reducing the amount of lint, dust, and trash particles which escapte into the air. If properly installed, they need little subsequent attention. Their cost over that of the older, large-diameter, less efficient cyclones is also incorporated in the model gin costs.

Burning has long been a favorite means of disposing of gin trash. Open burning in most areas is no longer permitted under air pollution control regulations. However, burning in well-designed and carefully operated incinerators may be allowed in some installations. If burning is not permitted, gin waste usually disposed of this way will probably have to be hauled away. It may be returned to the land or deposited in some area where it can decompose. In areas where it is desirable to spread this waste back on the land as a conservation practice, and if this practice is permitted, some of the added cost of hauling will possibly be borne by land owners.

If incinerator burning is allowed, some burden could be taken off the incinerator by baling and selling the lint cleaner waste, or "motes." This waste is extremely difficult to burn and usually contributes greatly to the visible smoke discharge. Mote cleaning and baling can be almost automatic, but some cost will be incurred for installation and the periodic attention necessary. However, the market for motes, although unpredictable, usually yields at least enough to defray this added cost if not actually return a profit.

3/ McCaskill, Oliver L., and Vernon P. Moore. "Elimination of Lint Fly," The Cotton Gin and Oil Mill Press. Dec. 31, 1966.

4/ Alberson, David M., and Roy V. Baker. An In-line Air Filter for Collecting Cotton Gin Condenser Air Pollutants. ARS 42-103, Agr. Res. Serv., U.S. Dept. Agr., Sept. 1964.

EQUIPMENT SPECIFICATIONS

Cotton gins vary appreciably in physical characteristics even among plants of comparable capacities and of the same manufacture. Occasionally, gin plants are erected or modified on the basis of preferences of individual gin operators rather than on sound engineering principles. Gin engineers representing the manufacturers may try to appease the purchasers of their equipment by honoring their equipment arrangement preferences even though they may not fully agree with them.

Ginning engineers with the USDA cotton ginning research laboratory and those employed by the major gin manufacturers are continually experimenting with new ways and means of increasing the efficiency of gin handling and processing equipment. New techniques, principles, and designs are usually not released until they are fully tested and proven to be sound and reliable. In the long run, therefore, it is generally more satisfactory and less costly to rely on the judgment of these specialists and follow their recommendations rather closely.

Ginning machinery and equipment specifications vary throughout the Belt because of differences in methods of seed cotton harvest. Two principal methods of harvest are used in this country--machine picking and machine stripping. Hand picking and snapping, formerly common practices, have now declined to the point where their impact on processing is no longer of importance in determining gin specifications.

Mechanical picking, which is used in all areas except the High Plains and the Rolling Plains of Texas and western Oklahoma, differs from mechanical stripping mainly in the method by which the seed cotton is removed from the plant. The mechanical picker has two counter-rotating, vertical cylinders with mechanical fingers or spindles which grab and twist the locks of seed cotton from the open bolls. The mechanical stripper, on the other hand, literally strips the plant through the use of rotating brushes. Bolls, leaves, branches, pieces of bark, some sand, and stems are deposited in the trailer along with the seed cotton. The higher ratio of trash to lint resulting from this stripping operation requires that the gin have additional as well as larger equipment for materials handling and extracting.

The integrated processing and materials-handling line in a conventional cotton gin consists of a somewhat standardized array of machines and equipment. The sequential order of the major operational items is as follows: unloading system (suction fan and pipes), automatic feed control assembly, push fan to No. 1 dryer, No. 1 incline cleaner, pull fan through No. 1 cleaner, stick machine, push fan to No. 2 dryer, pull fan through No. 2 cleaner, overflow fan, trash fan, conveyor-distributor, extractor-feeders over each gin stand, gin stands, two stages of lint cleaning (in tandem), condenser exhaust fan, gin press, and seed-handling equipment. The additional extracting equipment required to handle the extra foreign material in the stripper-harvest areas includes an airline cleaner and a green boll trap which are installed ahead of the automatic feed control, a bur machine which is incorporated just before the second dryer, and a stick machine which follows the second incline cleaner.

The capacity of overhead equipment in cotton gins is generally determined by the width of the equipment. For gin plants with rated capacities of 6 to 8 bales an hour, 50-inch incline cleaners, separators, droppers, and automatic feed control units, and a 72-inch stick machine are specified (app. tables 19 and 20). For the stripper-harvest areas, a 50-inch airline cleaner and a 10-foot bur machine constitute the additional equipment requirements. For 10- to 12-bale gins, 72-inch cleaners, separators, and droppers, and a 96-inch stick machine are prescribed. The airline cleaner and bur machine required for processing machine-stripped seed cotton in gins of this size should be 72 inches and 14 feet wide, respectively, For gins rated in excess of 12 bales an hour, the overhead cleaning and drying network should be split. 5/ For gins rated at 14 to 16 bales an hour, each side of the split-stream system should incorporate equipment identical to that in the 6- to 8-bale plants. Each side of the overhead for 18- to 24-bale plants should be comparable to that prescribed for the 10- to 12-bale gins. For a gin rated at 30 bales an hour, 96-inch cleaners, droppers, and separators, and 120-inch stick machines are specified. For the 36-bale gin, the width of all overhead equipment would be increased to 120 inches.

CAPITAL REQUIREMENTS

The cost of erecting new gin plants has increased in recent years at an alarming rate. A decade or so ago, the expenditure of $250,000 in the construction of a single-battery gin would have been considered excessive. Today, larger and more elaborate single-battery plants costing up to $1 million or more are in existence. This increase in gin construction costs has been due not only to the continuing upward spiral in the general price level but also to the gradual increase in the sophistication of ginning machinery and the increasing demands for faster ginning rates and lint samples which will be assigned higher grades. Gin machinery is the single largest cost item in new plant construction. In cost estimates developed for the 10 model gin plants, the cost of machinery ranged between 70 and 80 percent of the total plant investment (excluding land). 6/ Estimated costs for the West Texas models, containing extra equipment required to properly gin machine-stripped seed cotton, were $6,000 to $30,000 higher than those for the West and the South, depending on size (table 1).

Gin buildings represent 12 to 18 percent of the total capital outlay. Much of this cost goes into the concrete foundation, which must be sufficiently strong to withstand the vibrational stresses induced by heavy ginning equipment operating at high speeds.

5/ Two separate cleaning and drying systems are installed in parallel positions, essentially doubling the seed cotton cleaning capacity of the plant. This is referred to as a "split-stream" system. In machine-picked areas, this split usually occurs following the automatic feed control. In machine-stripped areas it commences at the trailer with the use of 2 suction pipes instead of 1.

6/ Installation of automatic press, in 30- and 36-bale gin models, using preformed covering (fiber or cardboard carton) and automatic strapping assumed.

Table 1.--Estimated capital requirements for model ginning plants, by rated capacity, capital item, and harvest method, United States, 1970-71

Harvest method and capital item	Bale capacity per hour 1/									
	6	8	10	12	16	18	20	24	30	36
	1,000 dollars									
Machine picked:										
Land 2/	12	12	14	14	16	18	18	20	25	30
Gin buildings 3/	40	40	50	50	60	60	70	80	105	130
Gin machinery	160	190	220	250	320	360	400	490	4/ 630	4/ 770
Outside equipment 5/	13	13	16	16	17	17	18	26	36	40
Tools	2	2	3	3	3	3	3	4	5	6
Office buildings and equipment 6/	9	9	10	11	11	12	12	14	18	22
Total	236	266	313	344	427	470	521	634	819	998
Machine stripped:										
Land 2/	12	12	14	14	16	18	18	20	25	30
Gin buildings 3/	40	40	50	50	60	60	70	80	105	130
Gin machinery	166	196	228	258	335	381	421	511	4/ 680	4/ 800
Outside equipment 5/	13	13	16	16	17	17	18	26	36	40
Tools	2	2	3	3	3	3	3	4	5	6
Office buildings. and equipment 6/	9	9	10	11	11	12	12	14	18	22
Total	242	272	321	352	442	491	542	655	869	1,028

1/ Manufacturers' rating.
2/ Based on estimated land value of $1,000 an acre.
3/ Includes foundation.
4/ Installation of automatic press using preformed bale covering (fiber or cardboard carton) and automatic strapping assumed.
5/ Includes cyclones, piping, seed hopper, bale trailer, auto, and truck.
6/ Includes furniture, fixtures, and scales.

Careful planning of land requirements is necessary in selecting each gin plant site. 7/ Acreage needs will vary depending on whether baled lint is to be moved directly from the gin to the warehouse or stored on the yard indefinitely. 8/

OPERATING COSTS

Operating costs in the following discussions are based on full seasonal capacities. Similar costs for each of the 10 models at reduced seasonal capacity levels (90, 80, and 70 percent) are shown in appendix A. Supplemental tables have also been included to help explain the derivation of costs for specific items.

Economies of scale become increasingly evident as plant size increases. At full rated seasonal capacities, total cost estimates per bale ranged from $18.85 to $12.80 in the West, $19.03 to $13.19 in West Texas, and $17.98 to $12.61 in the South for the 6- through the 36-bale gin models (tables 2, 3, and 4).

Fixed Costs

Fixed costs accrue regardless of volume ginned. Items treated as fixed in this study include depreciation, interest, insurance, taxes, and management.

Depreciation

The single most important fixed cost item for the model gins was depreciation Ginning firms frequently depreciate out their machinery in 10 or 20 years. However, the useful life of this equipment is usually 20 years at least. Even at this rate, and operating at full seasonal volume over the range in ginning capacities studied, depreciation costs per bale varied from $2.42 for the smallest model gin to $1.75 for the largest in both the West and South; and from $2.49 to $1.80, respectively, for these two models in West Texas.

Interest

The cost of interest on borrowed capital, or the opportunity cost of non-borrowed capital invested in the ginning operation, was set at 7 percent of the investment in land and at 7 percent on one-half of the investment in machinery and equipment. Interest costs per bale varied from $1.88 for the 6-bale model to $1.30 for the 36-bale model in both the West and South. Costs in West Texas were slightly higher, varying from $1.92 to $1.34, respectively, and reflecting the higher capital investment requirements for processing machine-stripped seed cotton.

7/ For detailed discussion of gin plant yard plans, see Handbook for Cotton Ginners. Agr. Handb. 260, Agr. Res. Serv., U.S. Dept. Agr., Feb. 1964.

8/ Yard storage for long periods in the West appears to be on the decline. Bales are now moved to the warehouse within a few days after ginning.

Table 2.--Estimated annual operating costs for model ginning plants, by rated capacity and cost item, the West 1/ 1970-71

Cost item	Bale capacity per hour 2/									
	6	8	10	12	16	18	20	24	30 3/	36 3/
	Dollars per bale									
Fixed costs:										
Depreciation	2.42	2.06	1.94	1.79	1.67	1.63	1.63	1.66	1.72	1.75
Interest	1.88	1.58	1.49	1.36	1.26	1.23	1.22	1.24	1.28	1.30
Insurance	.44	.39	.38	.36	.35	.34	.34	.35	.35	.36
Taxes	.84	.71	.67	.61	.57	.56	.56	.56	.58	.59
Management	2.05	1.83	1.70	1.62	1.51	1.47	1.44	1.40	1.36	1.33
Total fixed costs	7.63	6.57	6.18	5.74	5.36	5.23	5.19	5.21	5.29	5.33
Variable costs:										
Labor	3.78	3.37	3.12	2.96	2.48	2.45	2.42	2.19	1.76	1.58
Energy	1.13	.92	.81	.77	.79	.76	.72	.69	.74	.71
Bagging and ties	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.50	2.50
Repairs	1.61	1.57	1.55	1.52	1.46	1.43	1.40	1.34	1.26	1.18
Miscellaneous	1.70	1.69	1.67	1.66	1.63	1.62	1.61	1.58	1.54	1.50
Total variable costs	11.22	10.55	10.15	9.91	9.36	9.26	9.15	8.80	7.80	7.47
Total, all costs	18.85	17.12	16.33	15.65	14.72	14.49	14.34	14.01	13.09	12.80
Seasonal volume in bales 4/	4,620	6,160	7,700	9,240	12,320	13,860	15,400	18,480	23,100	27,720

1/ New Mexico, Arizona, California, and Nevada.
2/ Manufacturers' rating.
3/ Installation of automatic press using preformed bale covering (fiber or cardboard carton) and automatic strapping assumed.
4/ Operation at full capacity assumed for entire season.

Table 3.--Estimated annual operating costs for model ginning plants, by rated capacity and cost item, the South 1/ 1970-71

Cost item	Bale capacity per hour 2/									
	6	8	10	12	16	18	20	24	30 3/	36 3/
	Dollars per bale									
Fixed costs:										
Depreciation	2.42	2.06	1.94	1.79	1.67	1.63	1.63	1.66	1.72	1.75
Interest	1.88	1.58	1.49	1.36	1.26	1.23	1.22	1.24	1.28	1.30
Insurance	.37	.34	.32	.31	.30	.30	.30	.30	.30	.31
Taxes	.69	.59	.55	.51	.47	.46	.46	.47	.48	.49
Management	2.05	1.83	1.70	1.62	1.51	1.47	1.44	1.40	1.36	1.33
Total fixed costs	7.41	6.40	6.00	5.59	5.21	5.09	5.05	5.07	5.14	5.18
Variable costs:										
Labor	2.79	2.46	2.25	2.11	1.77	1.72	1.69	1.53	1.22	1.10
Energy	1.47	1.27	1.16	1.17	1.22	1.18	1.12	1.06	1.19	1.15
Bagging and ties	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.50	2.50
Repairs	1.61	1.57	1.55	1.52	1.46	1.43	1.40	1.34	1.26	1.18
Miscellaneous	1.70	1.69	1.67	1.66	1.63	1.62	1.61	1.58	1.54	1.50
Total variable costs	10.57	9.99	9.63	9.46	9.08	8.95	8.82	8.51	7.71	7.43
Total, all costs	17.98	16.39	15.63	15.05	14.29	14.04	13.87	13.58	12.85	12.61
Seasonal volume in bales 4/	4,620	6,160	7,700	9,240	12,320	13,860	15,400	18,480	23,100	27,720

1/ Machine-picked areas of Texas, the Midsouth, and the Southeast.
2/ Manufacturers' rating.
3/ Installation of automatic press using preformed bale covering (fiber or cardboard carton) and automatic strapping assumed.
4/ Operation at full capacity assumed for entire season.

Table 4.--Estimated annual operating costs for model ginning plants, by rated capacity and cost item, West Texas 1/ 1970-71

Cost item	Bale capacity per hour 2/									
	6	8	10	12	16	18	20	24	30 3/	36 3/
	Dollars per bale									
Fixed costs:										
Depreciation	2.49	2.11	1.99	1.83	1.73	1.71	1.70	1.72	1.83	1.80
Interest	1.92	1.61	1.52	1.39	1.30	1.28	1.27	1.28	1.35	1.34
Insurance	.29	.26	.25	.24	.23	.23	.23	.23	.24	.24
Taxes	.57	.48	.45	.41	.39	.39	.38	.39	.41	.40
Management	2.05	1.83	1.70	1.62	1.51	1.47	1.44	1.40	1.36	1.33
Total fixed costs	7.32	6.29	5.91	5.49	5.16	5.08	5.02	5.02	5.19	5.11
Variable costs:										
Labor	3.42	2.95	2.68	2.49	2.26	2.18	2.12	1.90	1.42	1.26
Energy	1.51	1.32	1.24	1.21	1.32	1.23	1.20	1.12	1.21	1.17
Bagging and ties	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.50	2.50
Repairs	2.08	2.06	2.02	2.00	1.93	1.90	1.87	1.81	1.73	1.65
Miscellaneous	1.70	1.69	1.67	1.66	1.63	1.62	1.61	1.58	1.54	1.50
Total variable costs	11.71	11.02	10.61	10.36	10.14	9.93	9.80	9.41	8.40	8.08
Total, all costs	19.03	17.31	16.52	15.85	15.30	15.01	14.82	14.43	13.59	13.19
Seasonal volume in bales 4/	4,620	6,160	7,700	9,240	12,320	13,860	15,400	18,480	23,100	27,720

1/ High Plains and Rolling Plains of Texas, and western Oklahoma.
2/ Manufacturers' rating.
3/ Installation of automatic press using preformed bale covering (fiber or cardboard carton) and automatic strapping assumed.
4/ Operation at full capacity assumed for entire season.

Insurance

The cost of fire and comprehensive insurance for gin plants varies appreciably throughout the Cotton Belt. Estimates were based on information provided by key insuring firms representing each of the respective areas. Insurance was highest in the West, varying from $0.44 a bale for the smallest model to $0.36 for the largest. It was lowest in West Texas, varying from $0.29 to $0.24, respectively.

Taxes

The costs of real estate and personal property taxes, including licenses for gin-owned pickup trucks and automobiles, were estimated from information provided by tax assessors in each of the three areas studied. Again, the West had the highest rates and West Texas had the lowest. Tax costs per bale varied from $0.84 for the 6-bale plant to $0.59 for the 36-bale plant in the West, and from $0.57 to $0.40, respectively, in West Texas.

Management

It could be argued that management is not truly a fixed cost item. However, during the span of one ginning season, presumably most managers would be retained at their contracted salaries regardless of seasonal ginning volumes. This was the assumption made in this study.

The manager's salary was estimated to range from $6,000 for the smallest model to $16,000 for the largest for all geographic areas concerned. In addition, $0.75 a bale was added to cover the cost of office salaries, which were included as part of management costs. The resulting cost range was $2.05 to $1.33 a bale for the 6- and 36-bale models for all three geographic areas.

Total Fixed Costs

Total fixed costs per bale for the smallest through the largest of the 10 models varied from $7.63 to $5.33 in the West, $7.41 to $5.18 in the South, and $7.32 to $5.11 in West Texas.

Variable Costs

Variable costs accrue as output increases and theoretically are nonexistent at the zero level of production. Cost items in this category are labor, energy, bagging and ties, repairs, and miscellaneous.

Labor

The prescribed crew size and the consequent cost of gin labor for a specific gin model are determined by the rated hourly capacity and the method of harvest

employed. Number of employees required for each crew is based on observations made in gins during normal operations in three major cotton-producing areas. 9/ For gins designed to process machine-picked seed cotton, five men are recommended for the smallest model and 13 for the largest (table 5). In the machine-stripped areas one additional employee is required in model gins with rated capacities of 6, 8, 10, 12, 30, and 36 bales an hour, and two more men are needed in each of the other models.

The ginning operation can be divided into three specific crew functions: yard and suction, conditioning and ginning, and bale packaging. The number of men required for the yard and suction function ranges from two for the smallest model to five for the largest. For bale packaging, the range is two to four men. These recommendations are the same for both methods of harvest except for the yard and suction crew for the 16-, 18-, 20-, and 24-bale gins designed for machine-stripped cotton. Because of the greater volumes of material which must be handled through these gins, double suction unloading pipes requiring one extra man are necessary. Double suction pipes are specified for the 30- and 36-bale gins regardless of harvest method.

The number of crew members needed to carry out the conditioning and ginning function ranges from one to four in the machine-picked areas and from two to five in the stripper-harvest areas. The additional gin machinery and equipment required in the processing of machine-stripped seed cotton dictate the need for one additional man in the conditioning and ginning crew of each of the gin models specified. These recommendations are based on the anticipated use of the conventional unloading system (unloading fans and manually operated suction pipes) in all models. If, instead, an automatic unloading system should be incorporated in any of the prescribed models, one to three employees could be eliminated depending on the gin plant size being considered (table 6).

Similarities assumed for the harvesting-ginning periods throughout the Belt were length of season and percentage of crops ginned during the peak 2-week periods. The commencing date varies somewhat among geographic production areas and from year to year within a specific area. The shape of the harvest pattern, when plotted as a curve, will also vary. It was determined, however, that the season is usually completed within 14 to 16 weeks and that roughly one-third of the crop is ginned during the peak 2 weeks. The seasonal distribution of receipts and hourly crew requirements assumed in this study was developed on this basis (table 7).

An average of 84 days and 38 nights was considered typical for a gin operating without seed cotton storage facilities. Both the day and the night shifts would average 12 hours except during the very early and late stages of the harvest, when receipts are light and spotty. This provides a total of 864 hours during which the day crew would be on duty and available for ginning, and 456 hours of night crew availability.

9/ Cable, C. Curtis, Jr., Zolon M. Looney, and Charles A. Wilmot. Utilization and Cost of Labor for Ginning Cotton. Agr. Econ. Rept. 70, Econ. Res. Serv., U.S. Dept. Agr., Apr. 1965.

Table 5.--Crew size for model ginning plants, by rated capacity, function, and harvest method, United States, 1970-71

Harvest method and gin crew function	Bale capacity per hour 1/									
	6	8	10	12	16	18	20	24	30 2/	36 2/
	Men									
Machine picked:										
Yard and suction	2	3	3	3	3	3	3	4	5	5
Conditioning and ginning	1	1	1	2	2	3	3	3	3	4
Bale packaging	2	2	3	3	4	4	5	5	4	4
Total	5	6	7	8	9	10	11	12	12	13
Machine stripped:										
Yard and suction	2	3	3	3	4	4	4	5	5	5
Conditioning and ginning	2	2	2	3	3	4	4	4	4	5
Bale packaging	2	2	3	3	4	4	5	5	4	4
Total	6	7	8	9	11	12	13	14	13	14

1/ Manufacturers' rating.
2/ Installation of automatic press using preformed bale covering (fiber or cardboard carton) and automatic strapping assumed.

Table 6.--Crew requirements for conventional and automatic unloading systems for seed cotton, by rated capacity and harvest method, United States, 1970-71

Harvest method and unloading system	Bale capacity per hour 1/									
	6	8	10	12	16	18	20	24	30 2/	36 2/
	Men									
Machine picked:										
Conventional 3/	2	3	3	3	3	3	3	4	5	5
Automatic 4/	1	1	1	1	1	1	1	2	2	2
Saving	1	2	2	2	2	2	2	2	3	3
Machine stripped:										
Conventional 3/	2	3	3	3	4	4	4	5	5	5
Automatic 4/	1	1	1	1	1	1	1	2	2	2
Saving	1	2	2	2	3	3	3	3	3	3

1/ Manufacturers' rating.
2/ Installation of automatic press using preformed bale covering (fiber or cardboard carton) and automatic strapping assumed.
3/ Includes use of manually operated suction pipes.
4/ Dump unloading system with 2 pits and sets of cylinders and 1 vacuum.

Table 7.--Typical seasonal distribution of seed cotton receipts and estimated distribution of hourly gin crew requirements, by 2-week periods of harvesting-ginning season, United States, 1970-71 1/

Item	2-week periods							Estimated season total
	1	2	3	4	5	6	7	
Percentage of crop ginned 2/	2	14	33	25	16	6	4	100
Day crew:								
Days worked	12	12	12	12	12	12	12	84
Hours per day	8	12	12	12	12	8	8	--
Day-hours	96	144	144	144	144	96	96	864
Night crew:								
Nights worked	--	6	14	12	6	--	--	38
Hours per night	--	12	12	12	12	--	--	--
Night-hours	--	72	168	144	72	--	--	456
Total hours	96	216	312	288	216	96	96	3/ 1,320

1/ Assumes allowance of 12 days during first 2-week ginning period to train new crewmen and to make final repairs and adjustments; 6 night shifts during second ginning period to train new crewmen and also to make job sufficiently appealing to attract necessary laborers; and 6 night shifts during 5th ginning period to handle departure from normal ginning distribution and to make the job more attractive financially.

2/ Based on average for series of years taken from U.S. Department of Commerce, Cotton Production and Distribution.

3/ Number of duty hours for which crew was paid. Exceeds actual processing hours by 414.

Total man-hours to be charged to the ginning operation would range from a low of 6,600 for the 6-bale model in the machine-picked areas to a high of 18,480 for the 36-bale plant in the stripper-harvest areas (app. table 13). Wages paid employees vary among areas as do other agricultural wages. In the South, an hourly rate of $2.75 was assumed for ginners and $1.50 for other gin hands. In the West, these rates were set at $3 and $2.30, while in West Texas rates of $2.50 and $1.60 were assumed. An allowance was also made to cover the gin's contribution to the social security and workmen's compensation funds for its employees.

Gin size ratings used in this report are those of the manufacturers. These ginning rates may be attained or even exceeded for limited periods under optimum conditions, but are not routinely achieved. It is generally agreed that over the season, 85 percent of rated hourly capacity is a more realistic expectation.

Some gin plants may be capable of operating without interruption for indefinite periods of time. However, most gin operators have found it advisable to shut down for a short time during each shift to clean up and carry out preventive maintenance measures. In this study, one-half hour was so allocated from each 12-hour shift. Thus, the actual processing hours for the season were reduced to 906 although the crew was on duty and paid for a total of 1,320 hours. The actual hours of processing multiplied by the average hourly processing rate provided the seasonal capacity estimate for each of the models.

Energy

Energy costs per bale vary among geographic areas, mainly because of differences in utility rate schedules. Costs per bale were based on rate schedules employed by the utility companies selected as representative of the respective areas. Costs were highest in West Texas, where they ranged from $1.51 a bale for the 6-bale model to $1.12 for the 24-bale model. They were lowest in the West, where the range was $1.13 to $0.69 a bale, respectively. In all three areas, energy costs per bale increased slightly for the 30- and 36-bale models (app. table 14).

Bagging and Ties

Charges for bagging and ties fluctuate somewhat from year to year but do not appear to vary substantially among geographic areas. Neither is there evidence of any appreciable quantity discount favoring the larger plants. For simplicity and convenience, a fixed rate of $3 a bale for the 6- through the 24-bale models was adopted for all areas (tables 2, 3, and 4). This assumes the use of a conventional, low-density gin press employing jute or sugar bagging and steel ties in each of these plant sizes. The 30- and 36-bale models require presses with greater rated capabilities. New higher capacity presses have been designed, for the most part, to use a preformed bale covering and automatic strapping. The cost of a fiber or cardboard carton and the strapping necessary to contain a 500-pound bale at a density of 28 to 30 pounds, which is the capability of one of these new press models, was estimated at $2.50 a bale.

Repairs

Repair costs were assumed to be similar in the South and West, where seed cotton is harvested by spindle pickers. The estimated cost range for these two areas was $1.61 a bale for the smallest model to $1.18 for the largest. In West Texas, these costs are higher because of the extra wear and tear on elbows, fan shrouds, and other materials-handling and gin processing equipment. Repair costs there were estimated to range from $2.08 a bale for the 6-bale model to $1.65 for the 36-bale model.

Miscellaneous

Other variable costs of operating a gin include fuel for drying, supplies, other utilities, advertising, and so forth. These cost items combined comprise

a relatively minor part of the total ginning cost and no attempt was made to distinguish variations among geographic areas. A cost range of $1.70 a bale for the smallest model to $1.50 for the largest was arbitrarily selected for all areas.

Total Variable Costs

Total variable costs per bale for the 6- through the 36-bale models ranged from $11.22 to $7.47 in the West, $11.71 to $8.08 in West Texas, and $10.57 to $7.43 in the South.

FACTORS AFFECTING GIN PLANT SIZE DETERMINATION

In addition to operating costs, certain other factors enter into the selection of optimal gin size. Among the more important are production density, concentration of the harvest, availability of seed cotton storage, and assembly costs.

Production Density

Production or bale density is a measure of the total supply of seed cotton available for ginning in a given geographic area. In computing this figure, careful consideration must be given to the amount of total land use allocated to roads, railroads, rivers, lakes, wooded areas, buildings, and other uses. In many cases, land use for other than agricultural crop production may account for as much as 75 percent or more of the total area.

Concentration of Harvest

The harvesting-ginning seasonal pattern generally takes the form of a bell-shaped curve. Gin receipts of seed cotton are slow to arrive at first but build up rather rapidly as the season progresses to a midseason peak. They then drop off gradually as the harvest is completed. Approximately one-third of the total crop throughout the Belt is now ginned during a peak 2-week period.

Availability of Seed Cotton Storage

Total seasonal volume for a specific cotton gin is normally determined by the gin's capacity at the peak of the season. If all the receipts which arrive during this critical period can be ginned with a minimum of delay, the risk of losing gin customers to competition is minimized. However, this calls for the availability of extra ginning capacity during the relatively short period of about 2 weeks--capacity which will not be utilized throughout the remainder of the year.

The other alternative for meeting customer demands is to provide seed cotton storage so that receipts in excess of a gin's capacity can be held and ginned later when capacity is available. Since this alternative for increasing ginning capacity has many ramifications, it was not considered further in this study.

Assembly Cost

In areas of relatively uniform production densities, larger gin plants suffer the disadvantage of having to reach out greater distances for seed cotton to maintain the same seasonal rates of plant capacity utilization as their smaller counterparts. The cost and responsibility of assembling seed cotton at the gin are generally those of the producer. Therefore, he could be expected to accept the inconvenience and added cost of assembly at a more distant plant only so long as he can realize some compensatory saving from patronizing that plant.

Input cost factors required in assembling seed cotton are for hauling equipment and labor. A 6-bale, four-wheel, rubber-tired trailer hooked to a one-half-ton pickup truck appears to be a favorite combination with cotton farmers across the Belt. Annual operating costs of these input factors were computed for one of the three geographic areas into which the Belt was divided for this study. Similar computations can be made for the other two areas or for subregions within areas by substituting appropriate cost figures into the tables in the appendix.

The annual operating cost for a 6-bale trailer, which was considered fixed, was estimated at $167.50 (app. table 15). Fixed and variable costs were both considered in the operation of a one-half-ton pickup. These two costs combined totaled $1,657.25, or $0.1071 a mile (app. table 16). The wages of only one man, the pickup driver, were charged to assembly. These wages were also divided into fixed and variable costs. The fixed labor cost was based on an estimate of 1 hour consumed at the field and 20 minutes at the gin for each trip. The variable portion was based on an average round-trip road speed estimate of 30 miles an hour. At a wage rate of $1.60 an hour, the fixed cost is $2.13 a trip, or $0.36 a bale; the variable labor cost is $0.0533 a mile (app. table 17).

APPLICATION OF FINDINGS

Using data developed in previous sections and choosing from among several ginning facility alternatives, a theoretical situation involving the determination of optimal size was examined.

An area of about 250 square miles in the West has just been brought into cotton production, and area producers have organized to plan the construction and operation of their own ginning facilities. A plan has been proposed and adopted to provide ginning services on a nonprofit basis, with any overage to be returned to the patrons in the form of dividends. Now the question of optimizing the number, size, and location of gin plants must be resolved. Production density averaging approximately 100 bales a square mile is the conservative prediction for the area; total annual production of almost 25,000 bales is anticipated. Ginning facility alternatives which would provide the necessary total capacity, based on the models, are: (1) six 6-bale plants, (2) three 12-bale plants, (3) two 18-bale plants, or (4) one 36-bale plant. 10/ Economies of scale, noted

10/ Some excess of capacity is desirable in new gin construction to provide for yearly fluctuations or a possible general upward trend in production or productivity.

earlier in the text and shown in tables 2, 3, and 4, would clearly favor alternative 4 from the standpoint of operating costs alone, assuming equal rates of seasonal capacity utilization for all alternatives. However, the advantages of alternatives 1-3 over alternative 4 in shorter hauling distances and attendant savings in seed cotton assembly costs also must be considered.

Taking alternative 1, for example, let us assume that the total area would be divided into six equal parts with one 6-bale plant located in the center of each. This would reduce the average hauling distance (round trip) of 17.36 miles for the single gin plant under alternative 4, to 7.08 miles for each of the 6-bale gins under alternative 1 (table 8). However, the resulting saving in assembly cost would not be reduced proportionately since the unit cost of performing this function depends mainly on the number of seasonal trips per trailer (major assembly cost items are fixed). Hence, compared with the average assembly cost for alternative 1, the increase in travel distance under alternative 4 would raise the average cost of seed cotton assembly by $0.27 a bale. 11/ On the other hand, the estimated saving in ginning cost alone for alternative 4 compared with alternative 1 would be $6.37 a bale (table 9). 12/ This would amount to a net saving in total ginning and assembly cost of $6.10 a bale, or $152,500 annually, for alternative 4 over alternative 1. Although the comparative advantage of alternative 4 decreases with a reduction in number and an increase in size of plants suggested in each of the other alternatives, alternative 4 is still favored from a cost-saving standpoint. Compared with alternative 2, the cost advantage under alternative 4 would be $2.73 a bale, or approximately $68,250 a year. A comparison of alternatives 3 and 4 reveals a potential saving of $1.54 per bale, or $38,500 annually, for alternative 4. Therefore, based on the alternatives considered and assumptions made, alternative 4 has to be the economic choice.

The mechanics of reimbursing growers for seed cotton assembly could be carried out either on a flat rate basis, with all growers being paid a uniform rate per bale, or on a pro rata basis to be determined by distance from the gin. Under the flat rate alternative, the fixed assembly cost allowance would be determined by (1) the average number of seasonal trips per trailer and (2) the average travel distance from field to gin for all grower-patrons combined (table 8).

Under the pro rata or per mile method, the assembly cost allowance for each grower would be determined by (1) the average number of seasonal trips per trailer and (2) actual travel distance from field to gin (table 10).

Limiting the number of trailers in each farmer's fleet and thus making fuller use of individual trailers can be an extremely important factor in the control of unit assembly costs. For example, an increase in the average number of seasonal trips per trailer from seven to eight would result in a total saving of $12,500 for area producers, based on a $0.50 per bale reduction in seed cotton assembly cost (table 11).

11/ Assuming same number of seasonal trips per trailer regardless of gin size.

12/ Assuming each plant in the complex suggested under alternative 1 would receive a proportionate share of the business and, hence, would operate at the same seasonal capacity utilization rate as the 36-bale plant in alternative 4 (25,000 ÷ 27,720 = 90 percent).

Table 8.--Assembly cost using one-half-ton pickup truck and a 6-bale trailer, by number of trips per trailer and average distance for assembly for each specified gin model with production density of 100 bales per square mile, the West, 1970-71 1/

Item	Bale capacity per hour 2/									
	6	8	10	12	16	18	20	24	30	36
Average distance in miles (round trip) 3/	7.08	8.18	9.14	10.02	11.56	12.28	12.94	14.18	15.84	17.36
	Dollars per bale									
Trips per trailer:										
1	28.47	28.50	28.52	28.55	28.59	28.61	28.63	28.66	28.70	28.74
2	14.51	14.54	14.56	14.59	14.63	14.65	14.67	14.70	14.74	14.78
3	9.86	9.89	9.91	9.94	9.98	10.00	10.02	10.05	10.09	10.13
4	7.53	7.56	7.58	7.61	7.65	7.67	7.69	7.72	7.76	7.80
5	6.13	6.16	6.18	6.21	6.25	6.27	6.29	6.32	6.36	6.40
6	5.20	5.23	5.25	5.28	5.32	5.34	5.36	5.39	5.43	5.47
7	4.54	4.57	4.59	4.62	4.66	4.68	4.70	4.73	4.77	4.81
8	4.04	4.07	4.09	4.12	4.16	4.18	4.20	4.23	4.27	4.31
9	3.65	3.68	3.70	3.73	3.77	3.79	3.81	3.84	3.88	3.92
10	3.34	3.37	3.39	3.42	3.46	3.48	3.50	3.53	3.57	3.61
11	3.09	3.12	3.14	3.17	3.21	3.23	3.25	3.28	3.32	3.36
12	2.88	2.91	2.93	2.96	3.00	3.02	3.04	3.07	3.11	3.15
13	2.70	2.73	2.75	2.78	2.82	2.84	2.86	2.89	2.93	2.97
14	2.54	2.57	2.59	2.62	2.66	2.68	2.70	2.73	2.77	2.81
15	2.41	2.44	2.46	2.49	2.53	2.55	2.57	2.60	2.64	2.68

1/ Computation of assembly cost per bale, from field to gin (Sources: app. tables 15, 16, and 17):
Trailer = \$167.50 ÷ 6 (bales) ÷ number of trips.
Labor
- fixed = \$0.36 per bale
- variable = \$0.0533 ÷ 6 (bales) x number of miles (round trip).

Truck = \$0.1071 ÷ 6 (bales) x number of miles (round trip).

2/ Manufacturers' rating.

3/ Travel distance = 1.8476 r

$$r = \sqrt{\text{annual capacity of gin} \div \text{production density} \div 3.1416}$$

Table 9.--Differences in average ginning and assembly costs at 3 alternative ginning facilities compared with alternative 4, the West, 1970-71

Item	Differences in costs compared with alternative 4 1/		
	Alternative 1 2/	Alternative 2 3/	Alternative 3 4/
	Dollars		
Ginning, per bale 5/....	+ 6.37	+ 2.92	+ 1.67
Assembly, per bale.....	- .27	- .19	- .13
Combined:			
Per bale.....	+ 6.10	+ 2.73	+ 1.54
Total 6/.....	+ 152,500.00	+ 68,250.00	+ 38,500.00

1/ Alternative 4: 1 36-bale gin centrally located.
2/ Alternative 1: 6 6-bale gins evenly dispersed throughout the area.
3/ Alternative 2: 3 12-bale gins evenly dispersed throughout the area.
4/ Alternative 3: 2 18-bale gins evenly dispersed throughout the area.
5/ Appendix tables 1, 4, 6, and 10 and assuming 90-percent seasonal capacity utilization (25,000 ÷ 27,720 bales).
6/ Based on a total production estimate for the area of 25,000 bales annually.

Table 10.--Seed cotton assembly cost, by number of trips per trailer and round-trip travel distance, the West, 1970-71 1/

Number of trips per trailer	Travel distance in miles (round trip)									
	1	3	5	7	9	11	13	15	20	25
	Dollars per bale									
1	28.31	28.36	28.41	28.47	28.52	28.57	28.63	28.68	28.81	28.95
2	14.35	14.40	14.45	14.51	14.56	14.61	14.67	14.72	14.85	14.99
3	9.70	9.75	9.80	9.86	9.91	9.96	10.02	10.07	10.20	10.34
4	7.37	7.42	7.47	7.53	7.58	7.63	7.69	7.74	7.87	8.01
5	5.97	6.02	6.07	6.13	6.18	6.23	6.29	6.34	6.47	6.61
6	5.08	5.09	5.14	5.20	5.25	5.30	5.36	5.41	5.54	5.68
7	4.38	4.43	4.48	4.54	4.59	4.64	4.70	4.75	4.88	5.02
8	3.88	3.93	3.98	4.04	4.09	4.14	4.20	4.25	4.38	4.52
9	3.49	3.54	3.59	3.65	3.70	3.75	3.81	3.86	3.99	4.13
10	3.18	3.23	3.28	3.34	3.39	3.44	3.50	3.55	3.68	3.82
11	2.93	2.98	3.03	3.09	3.14	3.19	3.25	3.30	3.43	3.57
12	2.72	2.77	2.82	2.88	2.93	2.98	3.04	3.09	3.22	3.36
13	2.54	2.59	2.64	2.70	2.75	2.80	2.86	2.91	3.04	3.18
14	2.38	2.43	2.48	2.54	2.59	2.64	2.70	2.75	2.88	3.02
15	2.25	2.30	2.35	2.41	2.46	2.51	2.57	2.62	2.75	2.89

1/ Computation of assembly cost per bale, from field to gin (Sources: app. tables 15, 16, and 17):

Trailer = $167.50 ÷ 6 (bales) ÷ number of trips.

Labor - fixed = $0.36 per bale
- variable = $0.0533 ÷ 6 (bales) x number of miles (round trip).

Truck = $0.1071 ÷ 6 (bales) x number of miles (round trip).

Table 11.--Potential savings per bale with each successive increase per 1 seasonal trip per trailer, the West, 1970-71 1/

Number of trips per season	Saving per bale with 1 more trip
	Dollars
1	--
2	13.96
3	4.65
4	2.33
5	1.40
6	.93
7	.66
8	.50
9	.39
10	.31
11	.25
12	.21
13	.18
14	.16
15	.13

1/ See table 10 for actual costs.

Appendix table 1.--Estimated annual operating costs for 6-bale model ginning plant, at reduced rates of capacity utilization, 1/ by cost item and geographic area, 1970-71

Cost item	West 2/			South 3/			West Texas 4/		
	Rate of capacity utilization, in percent								
	90	80	70	90	80	70	90	80	70
	Dollars per bale								
Fixed costs:									
Depreciation	2.69	3.03	3.46	2.69	3.03	3.46	2.77	3.11	3.56
Interest	2.09	2.35	2.68	2.09	2.35	2.68	2.14	2.41	2.75
Insurance	.47	.51	.56	.39	.42	.46	.30	.33	.36
Taxes	.93	1.05	1.20	.77	.87	.99	.63	.71	.81
Management	2.19	2.37	2.61	2.19	2.37	2.61	2.19	2.37	2.61
Total fixed costs	8.37	9.31	10.51	8.13	9.04	10.20	8.03	8.93	10.09
Variable costs:									
Labor	3.91	4.07	4.28	2.89	3.01	3.17	3.54	3.69	3.88
Energy	1.21	1.31	1.44	1.51	1.57	1.64	1.53	1.57	1.61
Bagging and ties	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Repairs	1.62	1.62	1.62	1.62	1.62	1.62	2.08	2.10	2.11
Miscellaneous	1.71	1.71	1.72	1.71	1.71	1.72	1.71	1.71	1.72
Total variable costs	11.45	11.71	12.06	10.73	10.91	11.15	11.86	12.07	12.32
Total, all costs	19.82	21.02	22.57	18.86	19.95	21.35	19.89	21.00	22.41
Seasonal volume in bales	4,158	3,696	3,234	4,158	3,696	3,234	4,158	3,696	3,234

1/ Ratio of volume ginned to estimated total seasonal capacity.
2/ New Mexico, Arizona, California, and Nevada.
3/ Machine-picked areas of Texas, the Midsouth, and the Southeast.
4/ High Plains and Rolling Plains of Texas, and western Oklahoma.

Appendix table 2.--Estimated annual operating costs for 8-bale model ginning plant, at reduced rates of capacity utilization, 1/ by cost item and geographic area, 1970-71

Cost item	West 2/			South 3/			West Texas 4/		
	Rate of capacity utilization, in percent								
	90	80	70	90	80	70	90	80	70
	Dollars per bale								
Fixed costs:									
Depreciation	2.29	2.58	2.95	2.29	2.58	2.95	2.34	2.64	3.01
Interest	1.76	1.97	2.26	1.76	1.97	2.26	1.79	2.02	2.31
Insurance	.42	.46	.50	.36	.38	.42	.28	.30	.32
Taxes	.79	.89	1.01	.65	.73	.84	.53	.60	.69
Management	1.95	2.10	2.30	1.95	2.10	2.30	1.95	2.10	2.30
Total fixed costs	7.21	8.00	9.02	7.01	7.76	8.77	6.89	7.66	8.63
Variable costs:									
Labor	3.47	3.63	3.81	2.53	2.64	2.78	3.06	3.19	3.35
Energy	.99	1.08	1.18	1.31	1.36	1.43	1.34	1.37	1.41
Bagging and ties	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Repairs	1.58	1.60	1.60	1.58	1.60	1.60	2.07	2.07	2.08
Miscellaneous	1.69	1.70	1.70	1.69	1.70	1.70	1.69	1.70	1.70
Total variable costs	10.73	11.01	11.29	10.11	10.30	10.51	11.16	11.33	11.54
Total, all costs	17.94	19.01	20.31	17.12	18.06	19.28	18.05	18.99	20.17
Seasonal volume in bales	5,544	4,928	4,312	5,544	4,928	4,312	5,544	4,928	4,312

1/ Ratio of volume ginned to estimated total seasonal capacity.
2/ New Mexico, Arizona, California, and Nevada.
3/ Machine-picked areas of Texas, Midsouth, and the Southeast.
4/ High Plains and Rolling Plains of Texas, and western Oklahoma.

Appendix table 3.--Estimated annual operating costs for 10-bale model ginning plant, at reduced rates of capacity utilization, 1/ by cost item and geographic area, 1970-71

Cost item	West 2/			South 3/			West Texas 4/		
	Rate of capacity utilization, in percent								
	90	80	70	90	80	70	90	80	70
	Dollars per bale								
Fixed costs:									
Depreciation	2.16	2.43	2.77	2.16	2.43	2.77	2.22	2.49	2.85
Interest	1.65	1.86	2.12	1.65	1.86	2.12	1.69	1.90	2.18
Insurance	.41	.44	.48	.34	.37	.40	.27	.29	.31
Taxes	.74	.83	.95	.61	.69	.79	.50	.57	.65
Management	1.81	1.94	2.11	1.81	1.94	2.11	1.81	1.94	2.11
Total fixed costs	6.77	7.50	8.43	6.57	7.29	8.19	6.49	7.19	8.10
Variable costs:									
Labor	3.22	3.37	3.54	2.32	2.42	2.54	2.78	2.89	3.04
Energy	.87	.93	1.03	1.20	1.24	1.30	1.26	1.29	1.32
Bagging and ties	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Repairs	1.56	1.57	1.58	1.56	1.57	1.58	2.03	2.06	2.07
Miscellaneous	1.69	1.69	1.70	1.69	1.69	1.70	1.69	1.69	1.70
Total variable costs	10.34	10.56	10.85	9.77	9.92	10.12	10.76	10.93	11.13
Total, all costs	17.11	18.06	19.28	16.34	17.21	18.31	17.25	18.12	19.23
Seasonal volume in bales	6,930	6,160	5,390	6,930	6,160	5,390	6,930	6,160	5,390

1/ Ratio of volume ginned to estimated total seasonal capacity.
2/ New Mexico, Arizona, California, and Nevada.
3/ Machine-picked areas of Texas, Midsouth, and the Southeast.
4/ High Plains and Rolling Plains of Texas, and western Oklahoma.

Appendix table 4.--Estimated annual operating costs for 12-bale model ginning plant, at reduced rates of capacity utilization, 1/ by cost item and geographic area, 1970-71

Cost item	West 2/			South 3/			West Texas 4/		
	Rate of capacity utilization, in percent								
	90	80	70	90	80	70	90	80	70
	Dollars per bale								
Fixed costs:									
Depreciation	1.98	2.23	2.55	1.98	2.23	2.55	2.03	2.29	2.61
Interest	1.51	1.70	1.94	1.51	1.70	1.94	1.54	1.73	1.98
Insurance	.39	.41	.45	.33	.35	.38	.25	.27	.29
Taxes	.68	.76	.87	.56	.63	.72	.46	.52	.59
Management	1.71	1.83	1.99	1.71	1.83	1.99	1.71	1.83	1.99
Total fixed cost	6.27	6.93	7.80	6.09	6.74	7.58	5.99	6.64	7.46
Variable costs:									
Labor	3.06	3.18	3.35	2.18	2.28	2.40	2.58	2.69	2.83
Energy	.83	.90	.98	1.20	1.25	1.30	1.23	1.26	1.29
Bagging and ties	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Repairs	1.54	1.55	1.56	1.54	1.55	1.56	2.01	2.02	2.03
Miscellaneous	1.67	1.69	1.70	1.67	1.69	1.70	1.67	1.69	1.70
Total variable cost	10.10	10.32	10.59	9.59	9.77	9.96	10.49	10.66	10.85
Total, all costs	16.37	17.25	18.39	15.68	16.51	17.54	16.48	17.30	18.31
Seasonal volume in bales	8,316	7,392	6,468	8,316	7,392	6,468	8,316	7,392	6,468

1/ Ratio of volume ginned to estimated total seasonal capacity.
2/ New Mexico, Arizona, California, and Nevada.
3/ Machine-picked areas of Texas, Midsouth, and the Southeast.
4/ High Plains and Rolling Plains of Texas, and western Oklahoma.

Appendix table 5.--Estimated annual operating costs for 16-bale model ginning plant, at reduced rates of capacity utilization, 1/ by cost item and geographic area, 1970-71

Cost item	West 2/			South 3/			West Texas 4/		
	Rate of capacity utilization, in percent								
	90	80	70	90	80	70	90	80	70
	Dollars per bale								
Fixed costs:									
Depreciation	1.85	2.08	2.38	1.85	2.08	2.38	1.92	2.16	2.47
Interest	1.40	1.57	1.80	1.40	1.57	1.80	1.45	1.63	1.86
Insurance	.37	.40	.43	.32	.34	.36	.25	.26	.28
Taxes	.63	.71	.81	.52	.59	.67	.43	.49	.56
Management	1.59	1.70	1.83	1.59	1.70	1.83	1.59	1.70	1.83
Total fixed cost	5.84	6.46	7.25	5.68	6.28	7.04	5.64	6.24	7.00
Variable costs:									
Labor	2.56	2.68	2.81	1.82	1.89	2.00	2.34	2.44	2.57
Energy	.84	.91	1.00	1.26	1.30	1.36	1.34	1.37	1.40
Bagging and ties	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Repairs	1.48	1.49	1.51	1.48	1.49	1.51	1.96	1.97	2.00
Miscellaneous	1.66	1.67	1.69	1.66	1.67	1.69	1.66	1.67	1.69
Total variable cost	9.54	9.75	10.01	9.22	9.35	9.56	10.30	10.45	10.66
Total, all costs	15.38	16.21	17.26	14.90	15.63	16.60	15.94	16.69	17.66
Seasonal volume in bales	11,088	9,856	8,624	11,088	9,856	8,624	11,088	9,856	8,624

1/ Ratio of volume ginned to estimated total seasonal capacity.
2/ New Mexico, Arizona, California, and Nevada.
3/ Machine-picked areas of Texas, Midsouth, and the Southeast.
4/ High Plains and Rolling Plains of Texas, and western Oklahoma.

Appendix table 6.--Estimated annual operating costs for 18-bale model ginning plant, at reduced rates of capacity utilization, 1/ by cost item and geographic area, 1970-71

Cost item	West 2/			South 3/			West Texas 4/		
	Rate of capacity utilization, in percent								
	90	80	70	90	80	70	90	80	70
	Dollars per bale								
Fixed costs:									
Depreciation	1.81	2.04	2.33	1.81	2.04	2.33	1.90	2.13	2.44
Interest	1.37	1.54	1.76	1.37	1.54	1.76	1.43	1.61	1.84
Insurance	.36	.39	.43	.31	.33	.36	.25	.26	.28
Taxes	.62	.70	.79	.51	.58	.66	.43	.48	.55
Management	1.55	1.65	1.78	1.55	1.65	1.78	1.55	1.65	1.78
Total fixed costs	5.71	6.32	7.09	5.55	6.14	6.89	5.56	6.13	6.89
Variable costs:									
Labor	2.53	2.63	2.77	1.79	1.86	1.96	2.26	2.35	2.47
Energy	.81	.88	.96	1.22	1.26	1.32	1.25	1.27	1.31
Bagging and ties	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Repairs	1.44	1.46	1.48	1.44	1.46	1.48	1.92	1.93	1.97
Miscellaneous	1.63	1.66	1.69	1.63	1.66	1.69	1.63	1.66	1.69
Total variable costs	9.41	9.63	9.90	9.08	9.24	9.45	10.06	10.21	10.44
Total, all costs	15.12	15.95	16.99	14.63	15.38	16.34	15.62	16.34	17.33
Seasonal volume in bales	12,474	11,088	9,702	12,474	11,088	9,702	12,474	11,088	9,702

1/ Ratio of volume ginned to estimated total seasonal capacity.
2/ New Mexico, Arizona, California, and Nevada.
3/ Machine-picked areas of Texas, Midsouth, and the Southeast.
4/ High Plains and Rolling Plains of Texas, and western Oklahoma.

Appendix table 7.--Estimated annual operating costs for 20-bale model ginning plant, at reduced rates of capacity utilization, 1/ by cost item and geographic area, 1970-71

Cost item	West 2/			South 3/			West Texas 4/		
	Rate of capacity utilization, in percent								
	90	80	70	90	80	70	90	80	70
	Dollars per bale								
Fixed costs:									
Depreciation	1.81	2.04	2.33	1.81	2.04	2.33	1.89	2.13	2.43
Interest	1.36	1.53	1.75	1.36	1.53	1.75	1.41	1.59	1.82
Insurance	.36	.39	.43	.31	.33	.36	.24	.26	.28
Taxes	.62	.69	.79	.51	.57	.66	.43	.48	.55
Management	1.52	1.62	1.74	1.52	1.62	1.74	1.52	1.62	1.74
Total fixed costs	5.67	6.27	7.04	5.51	6.09	6.84	5.49	6.08	6.82
Variable costs:									
Labor	2.50	2.60	2.74	1.75	1.83	1.93	2.19	2.30	2.41
Energy	.77	.84	.91	1.16	1.20	1.25	1.22	1.24	1.28
Bagging and ties	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Repairs	1.42	1.44	1.46	1.42	1.44	1.46	1.90	1.93	1.96
Miscellaneous	1.63	1.65	1.66	1.63	1.65	1.66	1.63	1.65	1.66
Total variable costs	9.32	9.53	9.77	8.96	9.12	9.30	9.94	10.12	10.31
Total, all costs	14.99	15.80	16.81	14.47	15.21	16.14	15.43	16.20	17.13
Seasonal volume in bales	13,860	12,320	10,780	13,860	12,320	10,780	13,860	12,320	10,780

1/ Ratio of volume ginned to estimated total seasonal capacity.
2/ New Mexico, Arizona, California, and Nevada.
3/ Machine-picked areas of Texas, Midsouth, and the Southeast.
4/ High Plains and Rolling Plains of Texas, and western Oklahoma.

Appendix table 8.--Estimated annual operating costs for 24-bale model ginning plant, at reduced rates of capacity utilization, 1/ by cost item and geographic area, 1970-71

Cost item	West 2/			South 3/			West Texas 4/		
	Rate of capacity utilization, in percent								
	90	80	70	90	80	70	90	80	70
	Dollars per bale								
Fixed costs:									
Depreciation	1.85	2.08	2.37	1.85	2.08	2.37	1.91	2.15	2.45
Interest	1.38	1.55	1.77	1.38	1.55	1.77	1.42	1.60	1.83
Insurance	.37	.40	.43	.32	.34	.36	.25	.26	.28
Taxes	.63	.70	.80	.52	.58	.67	.43	.48	.55
Management	1.47	1.56	1.68	1.47	1.56	1.68	1.47	1.56	1.68
Total fixed costs	5.70	6.29	7.05	5.54	6.11	6.85	5.48	6.05	6.79
Variable costs:									
Labor	2.26	2.36	2.48	1.58	1.65	1.73	1.96	2.05	2.16
Energy	.73	.78	.85	1.09	1.13	1.18	1.14	1.16	1.19
Bagging and ties	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Repairs	1.36	1.39	1.41	1.36	1.39	1.41	1.83	1.87	1.90
Miscellaneous	1.61	1.63	1.66	1.61	1.63	1.66	1.61	1.63	1.66
Total variable costs	8.96	9.16	9.40	8.64	8.80	8.98	9.54	9.71	9.91
Total, all costs	14.66	15.45	16.45	14.18	14.91	15.83	15.02	15.76	16.70
Seasonal volume in bales	16,632	14,784	12,936	16,632	14,784	12,936	16,632	14,784	12,936

1/ Ratio of volume ginned to estimated total seasonal capacity.
2/ New Mexico, Arizona, California, and Nevada.
3/ Machine-picked areas of Texas, Midsouth, and the Southeast.
4/ High Plains and Rolling Plains of Texas, and western Oklahoma.

Appendix table 9.--Estimated annual operating costs for 30-bale model ginning plant, 1/ at reduced rates of capacity utilization, 2/ by cost item and geographic area, 1970-71

Cost item	West 3/			South 4/			West Texas 5/		
	Rate of capacity utilization, in percent								
	90	80	70	90	80	70	90	80	70
	Dollars per bale								
Fixed costs:									
Depreciation	1.91	2.15	2.46	1.91	2.15	2.46	2.03	2.28	2.61
Interest	1.42	1.60	1.83	1.42	1.60	1.83	1.51	1.69	1.94
Insurance	.38	.40	.44	.32	.34	.37	.25	.27	.29
Taxes	.65	.73	.83	.54	.60	.69	.46	.51	.59
Management	1.42	1.51	1.62	1.42	1.51	1.62	1.42	1.51	1.62
Total fixed costs	5.78	6.39	7.18	5.61	6.20	6.97	5.67	6.26	7.05
Variable costs:									
Labor	1.81	1.88	1.98	1.26	1.33	1.39	1.46	1.52	1.61
Energy	.79	.85	.92	1.23	1.28	1.33	1.22	1.25	1.28
Bagging and ties	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Repairs	1.29	1.32	1.34	1.29	1.32	1.34	1.75	1.78	1.80
Miscellaneous	1.56	1.60	1.61	1.56	1.60	1.61	1.56	1.60	1.61
Total variable costs	7.95	8.15	8.35	7.84	8.03	8.17	8.49	8.65	8.80
Total, all costs	13.73	14.54	15.53	13.45	14.23	15.14	14.16	14.91	15.85
Seasonal volume in bales	20,790	18,480	16,170	20,790	18,480	16,170	20,790	18,480	16,170

1/ Installation of automatic press using preformed bale covering (fiber or cardboard carton) and automatic strapping assumed.
2/ Ratio of volume ginned to estimated total seasonal capacity.
3/ New Mexico, Arizona, California, and Nevada.
4/ Machine-picked areas of Texas, Midsouth, and the Southeast.
5/ High Plains and Rolling Plains of Texas, and western Oklahoma.

Appendix table 10.--Estimated annual operating costs for 36-bale model ginning plant, 1/ at reduced rates of capacity utilization, 2/ by cost item and geographic area, 1970-71

Cost item	West 3/			South 4/			West Texas 5/		
	Rate of capacity utilization, in percent								
	90	80	70	90	80	70	90	80	70
	Dollars per bale								
Fixed costs:									
Depreciation	1.94	2.18	2.49	1.94	2.18	2.49	2.00	2.25	2.57
Interest	1.44	1.62	1.85	1.44	1.62	1.85	1.48	1.67	1.91
Insurance	.38	.41	.45	.32	.35	.37	.25	.27	.29
Taxes	.66	.74	.84	.54	.61	.70	.45	.50	.58
Management	1.39	1.47	1.57	1.39	1.47	1.57	1.39	1.47	1.57
Total fixed costs	5.81	6.42	7.20	5.63	6.23	6.98	5.57	6.16	6.92
Variable costs:									
Labor	1.63	1.70	1.79	1.14	1.19	1.24	1.32	1.37	1.44
Energy	.76	.82	.89	1.19	1.23	1.28	1.19	1.21	1.24
Bagging and ties	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Repairs	1.22	1.26	1.28	1.22	1.26	1.28	1.67	1.70	1.72
Miscellaneous	1.53	1.56	1.57	1.53	1.56	1.57	1.53	1.56	1.57
Total variable costs	7.64	7.84	8.03	7.58	7.74	7.87	8.21	8.34	8.47
Total, all costs	13.45	14.26	15.23	13.21	13.97	14.85	13.78	14.50	15.39
Seasonal volume in bales	24,948	22,176	19,404	24,948	22,176	19,404	24,948	22,176	19,404

1/ Installation of automatic press using preformed bale covering (fiber or cardboard carton) and automatic strapping assumed.

2/ Ratio of volume ginned to estimated total seasonal capacity.

3/ New Mexico, Arizona, California, and Nevada.

4/ Machine-picked areas of Texas, Midsouth, and the Southeast.

5/ High Plains and Rolling Plains of Texas, and western Oklahoma.

Appendix table 11.--Estimated annual depreciation cost for model ginning plants, by rated ginning capacity, capital item, and harvest method, United States, 1970-71 1/

Harvest method and major capital item	Bale capacity per hour 2/									
	6	8	10	12	16	18	20	24	30	36
	Dollars									
Machine picked:										
Gin building 3/	2,000	2,000	2,500	2,500	3,000	3,000	3,500	4,000	5,250	6,500
Gin machinery	8,000	9,500	11,000	12,500	16,000	18,000	20,000	24,500	31,500	38,500
Outside equipment 4/	650	650	800	800	850	850	900	1,300	1,800	2,000
Tools	100	100	150	150	150	150	150	200	250	300
Office buildings and equipment 5/	450	450	500	550	550	600	600	700	900	1,100
Total	11,200	12,700	14,950	16,500	20,550	22,600	25,150	30,700	39,700	48,400
Machine stripped:										
Gin buildings 3/	2,000	2,000	2,500	2,500	3,000	3,000	3,500	4,000	5,250	6,500
Gin machinery	8,300	9,800	11,400	12,900	16,750	19,050	21,050	25,550	34,000	40,000
Outside equipment 4/	650	650	800	800	850	850	900	1,300	1,800	2,000
Tools	100	100	150	150	150	150	150	200	250	300
Office buildings and equipment 5/	450	450	500	550	550	600	600	700	900	1,100
Total	11,500	13,000	15,350	16,900	21,300	23,650	26,200	31,750	42,200	49,900

1/ Depreciation calculated by straight-line method at 5 percent annually.
2/ Manufacturers' rating.
3/ Includes foundations.
4/ Includes cyclones, piping, seed hopper, bale trailer, and so forth.
5/ Includes furniture, fixtures, and scales.

Appendix table 12.--Estimated annual interest on investment for model ginning plants, by rated ginning capacity, capital item, and harvest method, United States, 1970-71 1/

Harvest method and major capital item	Bale capacity per hour 2/									
	6	8	10	12	16	18	20	24	30	36
	Dollars									
Machine picked:										
Land 3/	840	840	980	980	1,120	1,260	1,260	1,400	1,750	2,100
Gin buildings 4/	1,400	1,400	1,750	1,750	2,100	2,100	2,450	2,800	3,675	4,550
Gin machinery	5,600	6,650	7,700	8,750	11,200	12,600	14,000	17,150	22,050	26,950
Other	840	840	1,015	1,050	1,085	1,120	1,155	1,540	2,065	2,380
Total	8,680	9,730	11,445	12,530	15,505	17,080	18,865	22,890	29,540	35,980
Machine stripped:										
Land 3/	840	840	980	980	1,120	1,260	1,260	1,400	1,750	2,100
Gin buildings 4/	1,400	1,400	1,750	1,750	2,100	2,100	2,450	2,800	3,675	4,550
Gin machinery	5,810	6,860	7,980	9,030	11,725	13,335	14,735	17,885	23,800	28,000
Other	840	840	1,015	1,050	1,085	1,120	1,155	1,540	2,065	2,380
Total	8,890	9,940	11,725	12,810	16,030	17,815	19,600	23,625	31,290	37,030

1/ Interest calculated at a rate of 7 percent for the cost of land and 7 percent of one-half of building, machinery, and other costs.
2/ Manufacturers' rating.
3/ Based on estimated land value of $1,000 an acre.
4/ Includes foundations.

Appendix table 13.--Estimated total inputs and costs of seasonal labor for model ginning plants, by rated ginning capacity and geographic area, 1970-71

Area 1/ and item	Unit	Bale capacity per hour 2/									
		6	8	10	12	16	18	20	24	30 3/	36 3/
West:											
Inputs--											
Ginners...	Man-hours	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320
Others....	Man-hours	5,280	6,600	7,920	9,240	10,560	11,880	13,200	14,520	14,520	15,840
Total...	Man-hours	6,600	7,920	9,240	10,560	11,880	13,200	14,520	15,840	15,840	17,160
Cost 4/--											
Ginners...	Dollars	4,289	4,289	4,289	4,289	4,289	4,289	4,289	4,289	4,289	4,289
Others....	Dollars	13,152	16,440	19,728	23,016	26,304	29,592	32,880	36,168	36,168	39,456
Total...	Dollars	17,441	20,729	24,017	27,305	30,593	33,881	37,169	40,457	40,457	43,745
South:											
Inputs--											
Ginners...	Man-hours	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320
Others....	Man-hours	5,280	6,600	7,920	9,240	10,560	11,880	13,200	14,520	14,520	15,480
Total...	Man-hours	6,600	7,920	9,240	10,560	11,880	13,200	14,520	15,840	15,840	17,160
Cost 5/--											
Ginners...	Dollars	4,058	4,058	4,058	4,058	4,058	4,058	4,058	4,058	4,058	4,058
Other.....	Dollars	8,855	11,068	13,282	15,495	17,709	19,923	22,136	24,350	24,350	26,564
Total...	Dollars	12,913	15,126	17,340	19,553	21,767	23,981	26,194	28,408	28,408	30,622
West Texas:											
Inputs--											
Ginners...	Man-hours	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320
Others....	Man-hours	6,600	7,920	9,240	10,560	13,200	14,520	15,840	17,160	15,840	17,160
Total...	Man-hours	7,920	9,240	10,560	11,880	14,520	15,840	17,160	18,480	17,160	18,480
Cost 6/--											
Ginners...	Dollars	3,766	3,766	3,766	3,766	3,766	3,766	3,766	3,766	3,766	3,766
Others....	Dollars	12,051	14,461	16,872	19,282	24,102	26,512	28,923	31,333	28,923	31,333
Total...	Dollars	15,817	18,227	20,638	23,048	27,868	30,278	32,689	35,099	32,689	35,099

1/ West: New Mexico, Arizona, California, and Nevada. South: Machine-picked areas of Texas, the Midsouth, and the Southeast. West Texas: High and Rolling Plains of Texas, and western Oklahoma. 2/ Manufacturers' rating. 3/ Installation of automatic press using preformed bale covering (fiber or cardboard carton) and automatic strapping assumed. 4/ Based on wage rates of $3 an hour for the ginner in each crew and $2.30 an hour for other crew members. 5/ Based on wage rates of $2.75 an hour for the ginner in each crew and $1.50 an hour for other crew members. 6/ Based on wage rates of $2.60 an hour for the ginner in each crew and $1.60 an hour for other crew members.

Appendix table 14.--Estimated annual energy inputs and unit costs for model ginning plants, by rated ginning capacity and geographic area, 1970-71

Area and item	Unit	Bale capacity per hour 1/									
		6	8	10	12	16	18	20	24	30	36
Seasonal volume 2/	Bales	4,620	6,160	7,700	9,240	12,320	13,860	15,400	18,480	23,100	27,720
West 3/:											
Energy, total	Kw-hr.	243,844	282,374	327,635	391,129	551,197	600,554	639,716	726,264	999,768	1,168,675
Energy, per bale	Kw-hr.	52.78	45.84	42.55	42.33	44.74	43.33	41.64	39.30	43.28	42.16
Cost per kw-hr.	Cents	2.13	2.02	1.91	1.83	1.76	1.75	1.74	1.76	1.72	1.68
South 4/:											
Energy, total	Kw-hr.	243,844	282,374	327,635	391,129	551,197	600,554	639,716	726,264	999,768	1,168,675
Energy, per bale	Kw-hr.	52.78	45.84	42.55	42.33	44.74	43.33	41.64	39.30	43.28	42.16
Cost per kw-hr.	Cents	2.78	2.78	2.74	2.76	2.73	2.73	2.71	2.71	2.76	2.73
West Texas 5/:											
Energy, total	Kw-hr.	264,125	308,678	362,054	425,594	616,123	645,737	699,776	786,324	1,057,749	1,227,996
Energy, per bale	Kw-hr.	57.17	50.11	47.02	46.06	50.01	46.59	45.44	42.55	45.79	44.30
Cost per kw-hr.	Cents	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64

1/ Manufacturers' rating.
2/ Operation at full capacity assumed for entire season.
3/ New Mexico, Arizona, California, and Nevada.
4/ Machine-picked areas of Texas, the Midsouth, and the Southeast.
5/ High Plains and Rolling Plains of Texas, and western Oklahoma.

Appendix table 15.--Annual operating cost, 6-bale trailer, the West, 1970

Cost item	Cost
	Dollars
Depreciation 1/	96.80
Interest on investment 2/	35.70
Tires 3/	15.00
Miscellaneous 4/	20.00
Total	167.50

1/ Based on a replacement value of $960, a depreciation rate of 8 percent, and no salvage value. Also includes depreciation rate of 33-1/3 percent on $60 tarpaulin used to cover seed cotton in transit.
2/ Based on rate of 7 percent applied to one-half the replacement cost or trailer and tarpaulin.
3/ One tire (used) per year.
4/ Includes repairs, maintenance, and property tax.

Appendix table 16.--Annual operating cost for a one-half-ton farm pickup truck, the West, 1970

Cost item	Cost 1/	
	Annual	Per mile
	Dollars	
Fixed costs:		
Depreciation 2/	500.00	.0333
Interest 3/	87.50	.0058
Insurance 4/	96.00	.0064
Taxes 5/	35.00	.0023
Total fixed costs	718.50	.0478
Variable costs:		
Gasoline 6/	562.50	.0375
Tires 7/	120.00	.0080
Repairs	150.00	.0100
Servicing	56.25	.0038
Total variable costs	888.75	.0593
Total fixed and variable costs	1,607.25	.1071

1/ Annual operation estimated at 15,000 miles.
2/ Based on a replacement value of $2,500, a depreciation rate of 25 percent, and a salvage value of $500.
3/ Based on a rate of 7 percent applied to one-half the replacement cost.
4/ $100,000/300,000 personal liability, $10,000 property damage, $100-deductible collision, $50-deductible comprehensive, and uninsured motorist.
5/ Includes license.
6/ Consumption rate--8 miles per gallon @ $.30 per gallon.
7/ One set of 4 tires annually.

Appendix table 17.--Labor cost for assembling seed cotton, the West, 1970 1/

Round-trip travel distance	Cost per trip			Cost per bale		
	Fixed 2/	Variable 3/	Total	Fixed 2/	Variable 3/	Total
Miles	Dollars					
2	2.13	.11	2.24	.36	.02	.38
4	2.13	.21	2.34	.36	.04	.40
6	2.13	.32	2.45	.36	.05	.41
8	2.13	.43	2.56	.36	.07	.43
10	2.13	.53	2.66	.36	.09	.45
12	2.13	.64	2.77	.36	.11	.47
14	2.13	.75	2.88	.36	.12	.48
16	2.13	.85	2.98	.36	.14	.50
18	2.13	.96	3.09	.36	.16	.52
20	2.13	1.07	3.20	.36	.18	.54
22	2.13	1.17	3.30	.36	.20	.56
24	2.13	1.28	3.41	.36	.21	.57
26	2.13	1.39	3.52	.36	.23	.59
28	2.13	1.49	3.62	.36	.25	.61
30	2.13	1.60	3.73	.36	.27	.63

1/ Based on average wage rate of $1.60 an hour and the equivalent of 6 bales of lint hauled per trailer load of seed cotton.

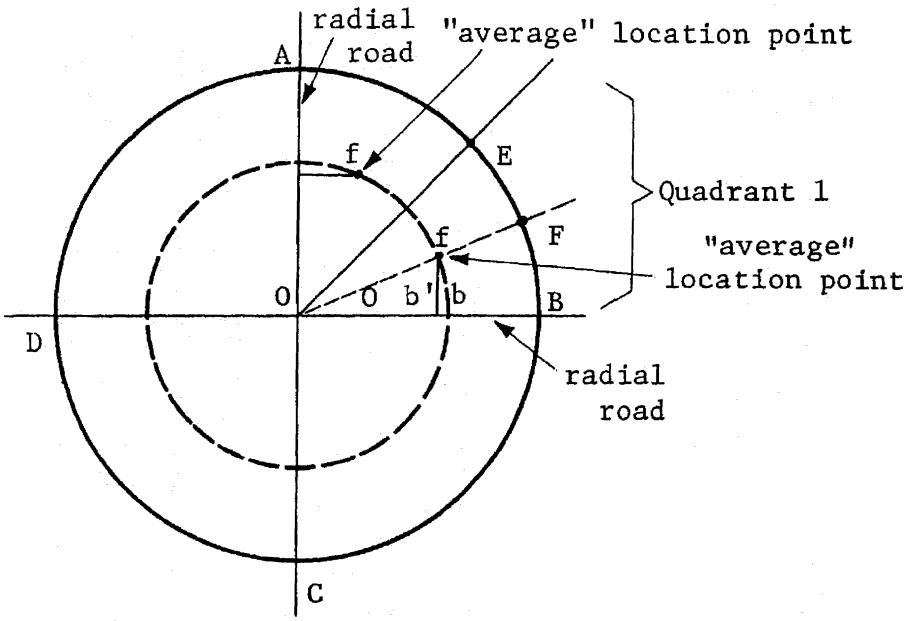
2/ Based on estimate of 1 hour consumed at the field and 20 minutes at the gin turnaround points.

3/ Based on an average round-trip road speed estimate of 30 miles an hour for a labor cost of $.0533 a mile.

APPENDIX B--SEED COTTON ASSEMBLY

Average Travel Distance 13/

Specification of average distance from field to gin implies certain basic assumptions regarding shape of production area, production density, and road pattern. Calculations were simplified in this study by assuming circular production areas, uniform production densities, and all roads laid out at right angles to one another. With the gin plant located at the center of the circle, there would be four radial roads which lead to the gin and which also divide the production area into quadrants. Half the seed cotton produced in each quadrant would be hauled to the gin plant over one of two radial roads forming the quadrant. In the case of quadrant 1, these two roads are OA and OB (see figure below). The intersection of a line bisecting the angle EOB and the arc of a circle circumscribing one-half the total production area (inner circle with radius Ob) is the "average" location point for this octant. The average hauling distance then would be the radial distance Ob' plus the lateral distance b'f (same for all octants).



Hypothetical circular production areas showing "average" location points (two in each quadrant).

Calculations:

$\pi\ (OB)^2$ = area = total production ÷ production density

$\pi\ (OB)^2 = \pi\ (OB)^2 \div 2$

$Ob = OB \div \sqrt{2} = 0.70711\ OB = Of$

$\angle\theta = 22\frac{1}{2}^{0}$

Radial travel distance = Ob' = cosine $\angle\theta$ (Of) = 0.92388 (Of) = 0.65328 OB

Lateral travel distance = b'f = sine $\angle\theta$ (Of) = 0.38268 (Of) = 0.27060 OB

Average travel distance - one way = 0.92388 OB

- round trip = 1.84776 OB

13/ Adapted from "Marketing New England Poultry. 5. Effects of Firm Size and Production Density on Assembly Costs." William F. Henry and Clark R. Burbee, N. H. Agr. Expt. Sta. Bul. 482, Apr. 1964.

Appendix table 18.--Horsepower requirements for unloading seed cotton at ginning plants by automatic and conventional systems, by rated ginning capacity, United States, 1970-71

Harvest method and equipment	Bale capacity per hour 1/									
	6		8		10		12		16	
	Actual hp.	Connected hp.	Actual hp.	Connected hp.	Actual hp.	Connected hp.	Actual hp.	Connected hp.	Actual hp.	Connected hp.
Conventional unloading										
Machine-picked:										
Equipment--										
Unloading fans	34.0	40.0	34.0	40.0	43.0	50.0	43.0	50.0	52.0	60.0
Feed control	4.0	5.0	4.0	5.0	6.0	7.5	6.0	7.5	6.0	7.5
Total horsepower	38.0	45.0	38.0	45.0	49.0	57.5	49.0	57.5	58.0	67.5
Machine-stripped:										
Equipment--										
Unloading fans	34.0	40.0	43.0	50.0	52.0	60.0	52.0	60.0	86.0	3/100.0
Feed control	4.0	5.0	4.0	5.0	6.0	7.5	6.0	7.5	8.0	2/10.0
Total horsepower	38.0	45.0	47.0	55.0	58.0	67.5	58.0	67.5	94.0	110.0
Automatic unloading										
Both methods:										
Equipment--										
Dump mechanism	0.6	2/10.0	0.8	2/10.0	1.0	2/10.0	1.2	2/10.0	1.6	2/10.0
Moving belt	2.2	2/10.0	2.4	2/10.0	2.6	2/10.0	2.8	2/10.0	3.2	2/10.0
Feed control	4.5	9.0	4.5	9.0	5.0	11.5	6.0	13.5	6.5	16.0
Total horsepower	7.3	29.0	7.7	29.0	8.6	31.5	10.0	33.5	11.3	36.0

Harvest method and equipment	Bale capacity per hour 1/									
	18		20		24		30		36	
	Actual hp.	Connected hp.	Actual hp.	Connected hp.	Actual hp.	Connected hp.	Actual hp.	Connected hp.	Actual hp.	Connected hp.
Conventional unloading										
Machine-picked:										
Equipment--										
Unloading fans	86.0	100.0	86.0	100.0	104.0	120.0	130.0	6/150.0	156.0	7/200.0
Feed control	7.0	7.5	7.0	7.5	7.0	7.5	15.0	23.5	17.6	23.5
Total horsepower	93.0	107.5	93.0	107.5	111.0	127.5	145.0	173.5	173.6	223.5
Machine-stripped:										
Equipment--										
Unloading fans	86.0	3/100.0	86.0	3/100.0	104.0	5/120.0	130.0	6/150.0	156.0	7/200.0
Feed contorl	12.0	4/15.0	12.0	4/15.0	12.0	4/15.0	15.0	23.5	17.6	23.5
Total horsepower	98.0	115.0	98.0	115.0	116.0	135.0	145.0	173.5	173.6	223.5
Automatic unloading										
Both methods:										
Equipment--										
Dump mechanism	1.8	2/10.0	2.0	2/10.0	2.4	2/10.0	4.0	10.0	4.0	10.0
Moving belt	3.4	2/10.0	3.6	2/10.0	4.0	2/10.0	8.0	10.0	8.0	10.0
Feed control	7.0	16.0	8.0	16.0	9.0	16.0	12.0	20.0	14.0	20.0
Total horsepower	12.2	36.0	13.6	36.0	15.4	36.0	24.0	40.0	26.0	40.0

1/ Manufacturers' rating.
2/ Two 5-horsepower motors.
3/ Two 50-horsepower motors.
4/ Two 7½-horsepower motors.
5/ Two 60-horsepower motors.
6/ Two 75-horsepower motors.
7/ Two 100-horsepower motors.

Appendix table 19.--Specifications of processing and materials handling equipment for model ginning plants in sequential operating order, by recommended size, actual power requirements, and connected load, machine-picked harvest areas, United States, 1970-71

Ginning equipment	Bale capacity per hour 1/														
	6			8			10			12			16		
	Equip-ment	Power needs:	Connected load*	Equip-ment	Power needs:	Connected load*	Equip-ment	Power needs:	Connected load*	Equip-ment	Power needs:	Connected load*	Equip-ment	Power needs:	Connected load*
	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.
Unloading fan	1-40	34	40.0	1-40	34	40.0	1-45	43	50.0	1-45	43	50.0	1-50	52	60.0
Feed control assembly	1-50"	4	5.0	1-50"	4	5.0	1-72"	6	7.5	1-72"	6	7.5	1-72"	6	7.5
Push fan, No. 1 dryer	1-35	25	30.0	1-35	25	30.0	1-35	25	30.0	1-40	30	40.0	2-35	50	2/60.0
No. 1 incline cleaner (vacuum wheel)	1-50"	4	5.0	1-50"	4	5.0	1-72"	5	7.5	1-72"	5	7.5	2-50"	8	3/10.0
Pull fan, No. 1 cleaner	1-35	26	30.0	1-35	26	30.0	1-35	26	30.0	1-40	30	40.0	2-35	52	2/60.0
Stick machine	1-72"	3	5.0	1-72"	3	5.0	1-96"	5	7.5	1-96"	5	7.5	2-72"	6	3/10.0
Push fan, No. 2 dryer	1-35	25	30.0	1-35	25	30.0	1-35	25	30.0	1-40	30	40.0	2-35	50	2/60.0
No. 2 incline cleaner (vacuum wheel)	1-50"	4	5.0	1-50"	4	5.0	1-72"	5	7.5	1-72"	5	7.5	2-50"	8	3/10.0
Pull fan, No. 2 cleaner	1-35	26	30.0	1-35	26	30.0	1-35	26	30.0	1-40	30	40.0	2-35	52	2/60.0
Distributor and overflow separator	--	4	5.0	--	4	5.0	--	5	7.5	--	5	7.5	--	6	7.5
Live overflow fan	1-30	12	20.0	1-30	12	20.0	1-35	21	25.0	1-35	21	25.0	1-40	30	40.0
Trash fan (feeders and gin stands)	1-30	12	20.0	1-30	12	20.0	1-35	21	25.0	1-35	21	25.0	1-40	30	40.0
Feeding, ginning, doffing	--	72	75.0	--	96	100.0	--	120	125.0	--	144	150.0	--	192	200.0
1st stage lint cleaning:															
Lint cleaner	--	14	15.0	--	20	30.0	--	23	30.0	--	28	45.0	--	40	60.0
Vane-axial fan	--	9	10.0	--	18	20.0	--	18	20.0	--	27	30.0	--	36	40.0
Mote fans	1-30	12	20.0	1-30	12	20.0	1-30	12	20.0	1-35	21	25.0	1-40	30	40.0
2nd stage lint cleaning:															
Lint cleaner	--	14	15.0	--	20	30.0	--	23	30.0	--	28	45.0	--	40	60.0
Vane-axial fan	--	9	10.0	--	18	20.0	--	18	20.0	--	27	30.0	--	36	40.0
Mote fans	1-30	12	20.0	1-30	12	20.0	1-30	12	20.0	1-35	21	25.0	1-40	30	40.0
Condenser	--	1	2.0	--	1	2.0	--	1	2.0	--	1	2.0	--	1	2.0
Condenser exhaust fan (vane-axial)	1-29"	8	10.0	1-29"	8	10.0	1-29"	8	10.0	1-29"	12	15.0	1-23"	12	15.0
Lint fly fan	1-30	10	15.0	1-30	12	15.0	1-30	14	15.0	1-30	14	15.0	1-35	18	20.0
Air compressor	--	2	5.0	--	2	5.0	--	2	5.0	--	2	5.0	--	2	5.0
Kicker and tramper	--	6	15.0	--	6	15.0	--	6	15.0	--	6	15.0	--	6	15.0
Press pump	--	3	25.0	--	4	25.0	--	5	25.0	--	6	25.0	--	8	25.0
Seed belt and trash auger	--	2	3.0	--	2	3.0	--	2	3.0	--	3	5.0	--	3	5.0
Seed blower	--	8	10.0	--	8	10.0	--	8	10.0	--	8	10.0	--	12	15.0
Total	--	361	475.0	--	418	550.0	--	485	607.5	--	579	739.5	--	816	1,007.0

Footnotes at end of table.

--Continued

Appendix table 19.--Specifications of processing and materials handling equipment for model ginning plants in sequential operating order, by recommended size, actual power requirements, and connected load, machine-picked harvest areas, United States, 1970-71--Continued

Ginning equipment	Bale capacity per hour 1/														
	18			20			24			30			36		
	Equipment	Power needs:	Connected load*	Equipment	Power needs:	Connected load*	Equipment	Power needs:	Connected load*	Equipment	Power needs:	Connected load*	Equipment	Power needs:	Connected load*
	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.
Unloading fan	2-45	86	100.0	2-45	86	100.0	2-50	104	120.0	--	130	6/150.0	--	156	7/200.0
Feed control assembly	1-96"	7	7.5	1-96"	7	7.5	1-96"	7	7.5	--	15	23.5	--	18	23.5
Push fan, No. 1 dryer	2-35	50	2/60.0	2-35	50	2/60.0	2-40	60	5/80.0	2-50	75	8/100.0	2-50	80	8/100.0
No. 1 incline cleaner (vacuum wheel)	2-72"	10	4/15.0	2-72"	10	4/15.0	2-72"	10	4/15.0	2-96"	15	9/20.0	2-120"	20	10/30.0
Pull fan, No. 1 cleaner	2-35	52	2/60.0	2-35	52	2/60.0	2-40	60	5/80.0	2-50	80	8/100.0	2-50	90	8/100.0
Stick machine	2-72"	6	3/10.0	2-96"	10	4/15.0	2-96"	10	4/15.0	2-120"	12	4/15.0	2-120"	12	4/15.0
Push fan, No. 2 dryer	2-35	50	2/60.0	2-35	50	2/60.0	2-40	60	5/80.0	2-50	75	8/100.0	2-50	80	8/100.0
No. 2 incline cleaner (vacuum wheel)	2-72"	10	4/15.0	2-72"	10	4/15.0	2-72"	10	4/15.0	2-96"	15	9/20.0	2-120"	20	10/30.0
Pull fan, No. 2 cleaner	2-35	52	2/60.0	2-35	52	2/60.0	2-45	60	5/80.0	2-50	80	8/100.0	2-50	90	8/100.0
Distributor and overflow separator	--	6	7.5	--	7	7.5	--	7	7.5	--	10	4/15.0	--	12	4/15.0
Live overflow fan	1-40	30	40.0	1-45	35	40.0	1-45	35	40.0	2-30	50	2/60.0	2-30	60	5/80.0
Trash fan (feeders and gin stands)	1-40	30	40.0	1-45	35	40.0	1-45	35	40.0	1-50	48	60.0	1-50	55	60.0
Feeding, ginning, doffing	--	216	225.0	--	240	250.0	--	288	300.0	--	360	375.0	--	432	450.0
1st stage lint cleaning:															
Lint cleaner	--	42	60.0	--	47	60.0	--	56	60.0	--	70	11/75.0	--	84	12/90.0
Vane-axial fan	--	36	40.0	--	36	40.0	--	36	40.0	--	45	50.0	--	54	60.0
Mote fans	1-40	30	40.0	1-40	30	40.0	1-40	30	40.0	1-40	35	40.0	1-40	40	50.0
2nd stage lint cleaning:															
Lint cleaner	--	42	60.0	--	47	60.0	--	56	60.0	--	70	11/75.0	--	84	12/90.0
Vane-axial fan	--	36	40.0	--	36	40.0	--	36	40.0	--	45	50.0	--	54	60.0
Mote fans	1-40	30	40.0	1-40	30	40.0	1-40	30	40.0	1-40	35	40.0	1-40	40	50.0
Condenser	--	1	2.0	--	1	2.0	--	1	2.0	--	2	3.0	--	2	3.0
Condenser exhaust fan (vane-axial)	1-36"	15	20.0	1-36"	16	20.0	1-36"	20	25.0	1-42"	25	30.0	1-42"	30	40.0
Lint fly fan	1-35	18	20.0	1-40	25	30.0	1-40	25	30.0	1-40	26	40.0	1-40	30	40.0
Air compressor	--	2	5.0	--	2	5.0	--	2	5.0	--	22	65.0	--	26	65.0
Kicker and tramper	--	6	15.0	--	6	15.0	--	6	15.0	--	26	50.0	--	30	50.0
Press pump	--	9	25.0	--	10	25.0	--	12	25.0	--	86	200.0	--	100	200.0
Seed belt and trash auger	--	5	7.5	--	5	7.5	--	5	7.5	--	10	15.0	--	10	15.0
Seed blower	--	12	15.0	--	12	15.0	--	14	15.0	--	18	25.0	--	21	25.0
Total	--	889	1,089.5	--	947	1,129.5	--	1,075	1,284.5	--	1,480	1,896.5	--	1,730	2,141.5

Footnotes at end of table.

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Appendix table 19.--Footnotes

1/ Manufacturers' rating.
2/ Two 30-horsepower motors.
3/ Two 5-horsepower motors.
4/ Two 7 1/2-horsepower motors.
5/ Two 40-horsepower motors.
6/ Two 75-horsepower motors.
7/ Two 100-horsepower motors.
8/ Two 50-horsepower motors.
9/ Two 10-horsepower motors.
10/ Two 15-horsepower motors.
11/ Five 15-horsepower motors.
12/ Six 15-horsepower motors.

*Note: The selection of sizes in electric motors is rather limited, often rendering it difficult to match connected horsepower exactly to actual load requirements. Furthermore, certain pieces of equipment--such as the press pump, kicker and tramper, and air compressor--require larger motors than indicated by their average power requirements, since their loads are not constant but build up as the peaks of their respective cycles approach.

Appendix table 20.--Specifications of processing and materials handling equipment for model ginning plants in sequential operating order, by recommended size, actual power requirements, and connected load, machine-stripped harvest areas, United States, 1970-71

Ginning equipment	Bale capacity per hour 1/														
	6			8			10			12			16		
	Equip-ment	Power needs:	Connected load*	Equip-ment	Power needs:	Connected load*	Equip-ment	Power needs:	Connected load*	Equip-ment	Power needs:	Connected load*	Equip-ment	Power needs:	Connected load*
	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.
Airline cleaner (4-cyl.)	1-50"	4	5.0	1-50"	4	5.0	1-72"	5	7.5	1-72"	5	7.5	2-50"	8	2/10.0
Unloading fan	1-40	34	40.0	1-45	43	50.0	1-50	52	60.0	1-50	52	60.0	2-45	86	4/100.0
Feed control assembly	1-50"	4	5.0	1-50"	4	5.0	1-72"	6	7.5	1-72"	6	7.5	2-50"	8	2/10.0
Push fan, No. 1 dryer	1-35	25	30.0	1-35	25	30.0	1-35	25	30.0	1-40	30	40.0	2-35	50	5/60.0
No. 1 incline cleaner (vacuum wheel)	1-50"	4	5.0	1-50"	4	5.0	1-72"	5	7.5	1-72"	5	7.5	2-50"	8	2/10.0
Pull fan, No. 1 cleaner	1-35	26	30.0	1-35	26	30.0	1-35	26	30.0	1-40	30	40.0	2-35	52	5/60.0
Bur machine	1-10'	5	7.5	1-10'	5	7.5	1-14'	7	10.0	1-14'	7	10.0	2-10'	10	3/15.0
Push fan, No. 2 dryer	1-35	25	30.0	1-35	25	30.0	1-35	25	30.0	1-40	30	40.0	2-35	50	5/60.0
No. 2 incline cleaner (vacuum wheel)	1-50"	4	5.0	1-50"	4	5.0	1-72"	5	7.5	1-72"	5	7.5	2-50"	8	2/10.0
Pull fan, No. 2 cleaner	1-35	26	30.0	1-35	26	30.0	1-35	26	30.0	1-40	30	40.0	2-35	52	5/60.0
Stick machine	1-72"	3	5.0	1-72"	3	5.0	1-96"	5	7.5	1-96"	5	7.5	2-72"	6	2/10.0
Distributor and overflow separator	--	4	5.0	--	4	5.0	--	5	7.5	--	5	7.5	--	6	7.5
Live overflow fan	1-30	12	20.0	1-30	12	20.0	1-35	21	25.0	1-35	21	25.0	1-40	30	40.0
Trash fan (feeders and gin stands)	1-30	12	20.0	1-30	12	20.0	1-35	21	25.0	1-35	21	25.0	1-40	30	40.0
Trash fan (bur machine and airline cleaner)	1-35	21	25.0	1-35	21	25.0	1-40	30	35.0	1-40	30	35.0	2-35	42	6/50.0
Feeding, ginning, doffing	--	72	75.0	--	96	100.0	--	120	125.0	--	144	150.0	--	192	200.0
1st stage lint cleaning:															
Lint cleaner	--	14	15.0	--	20	30.0	--	23	30.0	--	28	45.0	--	40	60.0
Vane-axial fan	--	9	10.0	--	18	20.0	--	18	20.0	--	27	30.0	--	36	40.0
Mote fans	1-30	12	20.0	1-30	12	20.0	1-30	12	20.0	1-35	21	25.0	1-40	30	40.0
2nd stage lint cleaning:															
Lint cleaner	--	14	15.0	--	20	30.0	--	23	30.0	--	28	45.0	--	40	60.0
Vane-axial fan	--	9	10.0	--	18	20.0	--	18	20.0	--	27	30.0	--	36	40.0
Mote fans	1-30	12	20.0	1-30	12	20.0	1-30	12	20.0	1-35	21	25.0	1-40	30	40.0
Condenser	--	1	2.0	--	1	2.0	--	1	2.0	--	1	2.0	--	1	2.0
Condenser exhaust fan (vane-axial)	1-29"	8	10.0	1-29"	8	10.0	1-29"	8	10.0	1-29"	12	15.0	1-29"	12	15.0
Lint fly fan	1-30	10	15.0	1-30	12	15.0	1-30	14	15.0	1-30	14	15.0	1-35	18	20.0
Air compressor	--	2	5.0	--	2	5.0	--	2	5.0	--	2	5.0	--	2	5.0
Kicker and tramper	--	6	15.0	--	6	15.0	--	6	15.0	--	6	15.0	--	6	15.0
Press pump	--	3	25.0	--	4	25.0	--	5	25.0	--	6	25.0	--	8	25.0
Seed belt and trash auger	--	2	3.0	--	2	3.0	--	2	3.0	--	3	5.0	--	3	5.0
Seed blower	--	8	10.0	--	8	10.0	--	8	10.0	--	8	10.0	--	12	15.0
Total	--	391	512.5	--	457	597.5	--	536	670.0	--	630	802.0	--	912	1,124.5

Footnotes at end of table.

--Continued

Appendix table 20.--Specifications of processing and materials handling equipment for model ginning plants in sequential operating order, by recommended size, actual power requirements, and connected load, machine-stripped harvest areas, United States, 1970-71--Continued

Ginning equipment	Bale capacity per hour 1/														
	18			20			24			30			36		
	Equipment	Power needs:	Connected load*	Equipment	Power needs:	Connected load*	Equipment	Power needs:	Connected load*	Equipment	Power needs:	Connected load*	Equipment	Power needs:	Connected load*
	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.	Number and size	Hp.	Hp.
Airline cleaner (4-cly.)	2-72"	10	3/15.0	2-72"	10	3/15.0	2-72"	10	3/15.0	2-96"	14	3/15.0	2-120"	16	9/20.0
Unloading fan	2-50	86	4/100.0	2-50	86	4/100.0	2-50	104	7/120.0	--	130	10/150.0	--	156	11/200.0
Feed control assembly	2-72"	12	3/15.0	2-72"	12	3/15.0	2-72"	12	3/15.0	--	15	23.5	--	18	23.5
Push fan, No. 1 dryer	2-35	50	5/60.0	2-35	50	5/60.0	2-40	60	8/80.0	2-50	75	4/100.0	2-50	80	4/100.0
No. 1 incline cleaner (vacuum wheel)	2-72"	10	3/15.0	2-72"	10	3/15.0	2-72"	10	3/15.0	2-96	15	9/20.0	2-120"	20	12/30.0
Pull fan, No. 1 cleaner	2-35	52	5/60.0	2-35	52	5/60.0	2-40	60	8/80.0	2-50	80	4/100.0	2-50	90	4/100.0
Bur machine	2-10'	10	3/15.0	2-14'	14	9/20.0	2-14'	14	9/20.0	2-120'	12	3/15.0	2-120'	12	3/15.0
Push fan, No. 2 dryer	2-35	50	5/60.0	2-35	50	5/60.0	2-40	60	8/80.0	2-50	75	4/100.0	2-50	80	4/100.0
No. 2 incline cleaner (vacuum wheel)	2-72"	10	3/15.0	2-72"	10	3/15.0	2-72"	10	3/15.0	2-96"	15	9/20.0	2-120"	20	12/30.0
Pull fan, No. 2 cleaner	2-35	52	5/60.0	2-35	52	5/60.0	2-40	60	8/80.0	2-50	80	4/100.0	2-50	90	4/100.0
Stick machine	2-72"	6	2/10.0	2-96"	10	3/15.0	2-96"	10	3/15.0	2-120"	12	3/15.0	2-120"	12	3/15.0
Distributor and overflow separator	--	6	7.5	--	7	7.5	--	7	7.5	--	10	3/15.0	--	12	3/15.0
Live overflow fan	1-40	30	40.0	1-45	35	40.0	1-45	35	40.0	2-30	50	5/60.0	2-30	60	8/80.0
Trash fan (feeders and gin stands)	1-40	30	40.0	1-45	35	40.0	1-45	35	40.0	1-50	48	60.0	1-50	55	60.0
Trash fan (bur machine and airline cleaner)	2-35	42	6/50.0	2-40	60	8/80.0	2-40	60	8/80.0	2-40	60	8/80.0	2-40	60	8/80.0
Feeding, ginning, doffing	--	216	225.0	--	240	250.0	--	288	300.0	--	360	375.0	--	432	450.0
1st stage lint cleaning:															
Lint cleaner	--	42	60.0	--	47	60.0	--	56	60.0	--	70	13/75.0	--	84	14/90.0
Vane-axial fan	--	36	40.0	--	36	40.0	--	36	40.0	--	45	50.0	--	54	60.0
Mote fans	1-40	30	40.0	1-40	30	40.0	1-40	30	40.0	1-40	35	40.0	1-40	40	50.0
2nd stage lint cleaning:															
Lint cleaner	--	42	60.0	--	47	60.0	--	56	60.0	--	70	13/75.0	--	84	14/90.0
Vane-axial fan	--	36	40.0	--	36	40.0	--	36	40.0	--	45	50.0	--	54	60.0
Mote fans	1-40	30	40.0	1-40	30	40.0	1-40	30	40.0	1-40	35	40.0	1-40	40	50.0
Condenser	--	1	2.0	--	1	2.0	--	1	2.0	--	2	3.0	--	2	3.0
Condenser exhaust fan (vane-axial)	1-36"	15	20.0	1-36"	16	20.0	1-36"	20	25.0	1-42"	25	30.0	1-42"	30	40.0
Lint fly fan	1-35	18	20.0	1-40	25	30.0	1-40	25	30.0	1-40	26	40.0	1-40	30	40.0
Air compressor	--	2	5.0	--	2	5.0	--	2	5.0	--	22	65.0	--	26	65.0
Kicker and tramper	--	6	15.0	--	6	15.0	--	6	15.0	--	26	50.0	--	30	50.0
Press pump	--	9	25.0	--	10	25.0	--	12	25.0	--	86	200.0	--	100	200.0
Seed belt and trash auger	--	5	7.5	--	5	7.5	--	5	7.5	--	10	15.0	--	10	15.0
Seed blower	--	12	15.0	--	12	15.0	--	14	15.0	--	18	25.0	--	21	25.0
Total	--	956	1,177.0	--	1,036	1,252.0	--	1,164	1,407.0	--	1,566	2,006.5	--	1,818	2,256.5

Footnotes at end of table.

--Continued

Appendix table 20.--Footnotes

1/ Manufacturers' rating.
2/ Two 5-horsepower motors.
3/ Two 7 1/2-horsepower motors.
4/ Two 50-horsepower motors.
5/ Two 30-horsepower motors.
6/ Two 25-horsepower motors.
7/ Two 60-horsepower motors.
8/ Two 40-horsepower motors.
9/ Two 10-horsepower motors.
10/ Two 75-horsepower motors.
11/ Two 100-horsepower motors.
12/ Two 15-horsepower motors.
13/ Five 15-horsepower motors.
14/ Six 15-horsepower motors.

Note: The selection of sizes in electric motors is limited, often rendering it difficult to match connected horsepower exactly to actual load requirement. Furthermore, certain pieces of equipment--such as the press pump, kicker and tramper, and air compressor--require larger motors than indicated by their average power requirements, since their loads are not constant but build up as the peaks of their respective cycles approach.